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EXPORT TRADE FEATURES.

During the past year, manufactured goods formed thirty-one and one-half per cent of the total United States exportations, a larger per cent than in any preceding period. The total value was $432,284,366 against $339,675,558 last year, an increase of not less than $92,608,808. Such figures indicate a rapid growth, for it is said that while our exports of manufactures are now ten times as valuable as in 1860, those of the United Kingdom are only one and one-half times as great, althought they are still twice as much as ours, giving an idea of the size of the trade and the magnitude of the markets where the United States has still to enjoy her rightful share of the trade.

The striking part of this growth of our export trade is that much of it has been spontaneous rather than planned and systematic. Conditions have often been opposed to it, but when goods are once known and are found to have merit, a beginning has been made that should be followed up. It is a gratifying feature of this year's Exposition at Paris that so many American concerns are there, completely outrunning all the estimates as to number and space required; but it remains to be seen how many of those who went to Paris will keep up the effort or will regard their exhibit as the one spasmodic attempt of their lives for trade expansion. It would, indeed, have been better to stay at home and save the money than not to push the campaign by all the means available, including those of publicity, which remains as cheap a way of cultivating the foreign market as can be found. Indeed, the use of such journals as this must long continue of pre-eminent benefit, until American exporters find all over the world, as do German and English merchants, a network of their own countrymen long established, with financial shipping and trading resources that are quite unfamiliar to our own people. In other words, this journal is read abroad, in the colonies, the tropics and the far East, by merchants and others who are not American, but who are being educated into an acquaintance with American goods and a knowledge of the fact that handling them is another source of income. This trading through foreigners is as much a fact of the day as is the carrying of the exports in foreign bottoms, and the numbers of inquiries that reach us from such firms as to American supplies and apparatus are already remarkably large. It is thus that our foreign trade must make some of its beginnings and grow, in many parts of the world.

THE GERMAN ELECTRICAL INDUSTRY.

Note is made elsewhere in this issue of the condition of the German electrical manufacturing industry. As a matter of fact, the period of industrial boom in Germany has closed, and electricity has suffered in common with other branches, so that it would not be fair to infer that there has been any special collapse or distress in this particular field. It is said that the Boerse generally has seen nothing quite so serious, since the German Empire was founded, as the present trade depression.

This may be so, but we think that many of our electrical German friends are sound in their conviction that the depression will not be half as bad as it seems. With regard to electrical development, if anybody believes Europe has reached its limit in that, all they have to do is to travel about the Continent a bit, when they will begin to marvel at the general electrical backwardness as

evidenced in the little use of telephones, electric lights or trolley lines. But of course new work must have capital, and if the sources of German capital were dried up, there would be less money available for electrical constructive enterprises of all kinds.

The leadership of Germany in electrical matters in Europe is certainly remarkable. To her all other countries look for advances in electro-chemistry, while it is well known that in the adoption of electric traction she has been most active and enterprising. As to electric lighting, it will be seen from the extensive data given in our Digest this week that during last year the number of central stations increased 163, bringing the total up to 652, while 122 more were in construction on March 1. Moreover, many towns are lighted from a single plant, as many as thirty in one instance, so that more towns now in Germany have electricity available than are supplied with gas. Some of the cities are liberal also in their use of the electric light. It is still the habit to talk of Paris as the Ville Lumiere, from the fact that one or two main thoroughfares are brilliantly lighted, while the rest of the city lies in mournful darkness. The fact is that Berlin compares more than favorably with Paris in this respect, and probably with London; though in general diffusion and brightness of light, New York and Chicago eclipse them all. To the American eye, all the European cities seem underlit, and the economy in illumination within doors is a matter of comment among all traveling Americans. Be this as it may, the extent to which Germany has gone in for electrical development is conspicuous and meritorious, and we trust the rate of advance there is not to be slackened.

Board of Trade Telegraphs.

It will have been noted that owing to the disputes that have arisen between the Chicago Board of Trade and the telegraph companies, as to the price to be paid for quotation privileges, the Board is now proposing to organize an elaborate system of its own, connecting all the leading commercial exchanges of the country. Such a system is estimated to cost $5,000,000, but no data is given out as to the cost of maintenance. This is by no means the first time that disputes have arisen in this manner over quotation reporting, and in New York has been seen the creation of a local ticker service of its own by the Stock Exchange. But the present attempt is probably the first of its kind of a definite nature to create a co-operative telegraph enterprise among all the produce exchanges.

We are doubtful as to the success of any such scheme. The managements of all the exchanges are continually changing, and that alone would be a terrible drawback to efficiency. Besides, the Boards would be involved in trouble all the time as to the maintenance of their circuits and apparatus, and, after all, their real business is not that of dispensing intelligence, but of making quotations. It is true they might object that the legitimate cause of complaint is the falling of their quotations into the hands of bucket-shops, but the figures go also into the columns of Wall Street financial papers, and the brokers on the stock and produce exchanges have not yet on that account clubbed together to publish a quotation journal of their own. In short, while always welcoming an increase of telegraphic facilities, we must confess that this new scheme seems to us to bristle with objections and difficulties.

"Avoid Omnibusses."

The recent heat wave in London has been, to borrow the latest phrase of New York, "something fierce," and has done a great deal of harm. As here, horses were greatly affected and many died; but for human beings the death returns were even heavier. No small amount of suffering came from the use of the omnibusses, and the London newspapers to hand quote the advice of leading physicians to avoid such conveyances. Almost universally, the windows of these out-of-date vehicles are fixed, and thus each omnibus, with the thermometer at 92 in the shade, becomes a Turkish bath or "sweat box" of the worst kind imaginable.

Possibly such a spell of weather will do more to help bring on the régime of the open trolley car in London than even the presence of the distinguished Mr. Yerkes. The average Londoner would be surprised, judging from our knowledge of him, if he could see the thousands of people in New York these dog days, just riding up and down town in the open trolley cars simply to enjoy the air and sunshine and catch the breeze made by the motion of the car. It is no exaggeration to say that hundreds of lives are saved every summer by such trolley-car trips.

Pacific Cables.

Just at this juncture the absence of news from Pekin is felt to be one of the most painful deprivations that a civilized community could endure. But it is forgotten in this country that even such news as we do get from China does not come to us direct and has to go the other way around the world. The fact that England is now getting ready to lay her Pacific cable should emphasize the necessity for ours also. Whatever news reaches this country comes to us practically only by the consent of England and Russia, who control the two cable systems touching that part of the globe. Either country or both might at any moment stop the service, and such a contingency is quite likely to arise, though not out of any enmity to us. As it is, American messages are subject to intolerable delay, and have to take a subordinate place when the question arises as to who shall have the cable first. In fact, it is perfectly safe to assert that some of our recent "rush" messages could only have been rushed with the express permission or help of the English or Danish cable authorities, who, had they been unfriendly, could have laid off or delayed those messages indefinitely without any declaration of hostility. The messages we are so eager to get through can be "hung up" anywhere anytime those authorities chose or are so instructed.

Now this situation is humiliating to a degree. Our interests in the East are certainly as great as they are in Europe, but at the present minute, our possessions might be snatched from us, our dependencies captured, our troops and fleets wiped out, our missionaries massacred, and our trade annihilated, without our being able to get authentic advices under a month, unless some one else chose to let us have the news. It is not a question of expansion or imperialism, but whether we propose in the near future to have a free hand in the Pacific. America does not want to meddle in other people's affairs out there, but she has got enough of her own right now to warrant the laying of an all-American Pacific cable, and it cannot go down too quickly.

It is true we can use an English Pacific cable just as we do English cables elsewhere, but that would not afford the freedom of communication which to a great commercial and advancing country like this is an imperative necessity. It is also true that the advantages of a Russo-Manchurian land line from China were also pointed out in these pages not long ago by a well-known public man, but we imagine that his views as to the freedom of such a line from interruption have been somewhat modified by recent events. The truth remains that a deep sea, straightaway American cable is the thing needful, and an American-built cable at that, for there is not a cable factory in Europe to-day that could touch the order for two or three years. Congress will do well next session to order that cable for prompt delivery for laying as soon as constructed. It might represent the cost of two or three proposed battleships but the ships of war we have already would then be worth two or three times as much for purposes of protection to our interests.

WIRELESS TELEGRAPHY.

It is perhaps unreasonable in the early stages of development of a new art to call loudly upon it for results. No one knows better than those who are in the struggle the eagerness with which results will be hailed. And very often the most disheartening obstacle is that lack of public encouragement and appreciation which generally confronts the investigator. But just at the present moment it is not inopportune to raise an inquiry touching the state of wireless telegraphy. Here is an art which for several years has been fruitful of promising and even startling results. It has attracted the most earnest efforts of as able a group of trained investigators as anywhere to be found. But we have yet to learn that wireless telegraphy has been of any tangible use to the world in any of the crises that have blackened the last year of the dying century. The British forces in South Africa have been living in a hornet's nest for the last six months, very largely on account of utterly inefficient means of communication, hard to establish and easy to interrupt. To take the lesson to ourselves, our forces in one uncomfortable annex have been bothered not a little in spite of all that a most capable but badly handicapped signal corps could do. And, finally, who can tell the precious service that would have been rendered if the gallant little band of marines beleaguered or immolated in Pekin had taken with them, as might easily have been, apparatus which would have kept them in instant touch with Tien-Tsin and the ill-fated relief column.

If there is any theoretical or practical reason why an effective wireless telegraph outfit for use in the field cannot be produced right now, let the wireless telegraphers arise and speak! If there is no such reason, let them none the less arise, speak and demonstrate that the blame may be placed where it belongs. If the lack of such apparatus in our army and navy is due to the neglect of the moss-backed bureaucrats who sent our artillery into action at Santiago with black powder, the public ought to know it, that the authors of the negligence may be properly pilloried. In other words, if wireless telegraphy is a good and practicable thing for military use, as seems more than probable, let the facts be set forth in such wise that the people may know whom to accuse when our forces are sent into the field unequipped. We are too far behind the times already without adding another and flagrant instance.

THE SOUNDER VERSUS THE TELEPHONE.

In many central stations, telephones are employed not only between the various offices of the staff, but also between the main station and sub-stations; or between different buildings in the main station itself. In a few stations these are replaced by sounders and the station operators signal to each other through the medium of the Morse code. The relative advantages of these two different sets of instruments are interesting to notice. The telephone requires no special skill to manipulate, and it may be switched on to any circuit at the local exchange. The inspector calling at a sub-station may thus be able to communicate with any officer in the station. On the other hand, the telephone with local battery, is a somewhat bulky apparatus to carry about, and needs some care in connecting up. It also requires two wires for its circuit, since any single-wire circuit issuing from a central power house would usually be too noisy for successful conversation. Telephone wires running parallel to alternating-current circuits have to be twisted pairs, and even from direct-current stations, the telephone wires must be transposed at intervals to avoid the inductive disturbance due to the working of the commutators. Even after the circuit has been controlled and brought into silence by electric symmetry, there is commonly much difficulty in speaking, on account of the noise of the running machinery. A telephone in an engine room requires to be well manipulated or encased and cabined if the speech sounds are not to be drowned by the noise of the engines.

From the above troubles the sounder is entirely free. It seems to take a positive delight in outsounding the loudest engines, and its gleeful click can be heard by the operator with ease if his ear is close to the instrument. The sounder is also very easily connected in circuit, requires no call-bell, and is usually free from local batteries, since central-station circuits are generally too short to call for relays. The sounder speaks more slowly, uttering, say fifteen or twenty words a minute in central-station use, against about one hundred words per minute by the glib telephone; but there is no doubt about what the sounder says. Moreover, only one wire is needed for the circuit, because inductive disturbance must be violent indeed when detected by the phlegmatic sounder.

The main disadvantage of the sounder is its language, which takes a trained ear to decipher, and a trained hand to write. But for the slow speeds that are needed in central-station conversation, this training need not be severe, and most central-station men can readily acquire the art by a little practice once the system is inaugurated and put in operation. The use of the sounder and Morse key is so valuable and important that its practice cannot be too widely encouraged. Everyone should know the Morse alphabet, and nearly everyone should try to read and write the Morse language.

ALTERNATING VERSUS CONTINUOUS.

We are gratified to note that the joint session of the American Institute and the British Institution of Electrical Engineers, is to be turned to such a pertinent and practical end as the subject announced for discussion indicates. To be sure "The Relative Advantages of Alternate and Continuous Currents for a General Supply of Electricity, Especially with Regard to Other Interests," suggests in length the title of one of Wordsworth's poems, but it also portends a discussion meet for words so weighty. The matters involved are of such great practical importance, they will well bear as long-continued and thorough discussion as time permits. The debate may at times wax acrimonious, possibly suggestive of a ward primary, but it will assuredly be interesting; and if in the heat of the fray some of the combatants begin to hurl about data which have so far been successfully concealed, even from the inquiring public, we shall have good reason to be grateful.

There are many things in both alternating and continuous-current practice which ought to be made public, and perhaps the exacerbation of the moment may bring them to light. It would be vastly interesting for example, to have disclosed the first cost and maintenance expense per unit of a low-tension distributing system, or the real life and average efficiency of alternating transformers used on a large scale. One would be gratified too, to hear the net average efficiencies of the two systems of distribution ruthlessly set forth. But the relations of these systems to other interests seem to form the special object of anxiety to our British friends, and this aspect of the case can safely be guaranteed to raise a wordy fracas even in the most amiable postprandial or ante-dejeuner mood of the assemblage. The matter is of less significance here than abroad, for in our free and easy way of doing things, other undertakings are generally left to hustle for themselves without any altruistic efforts on the part of the electric light and power companies. Still, as time goes on, we are likely to find questions of interference raised more frequently and strenuously, and a free discussion of the subject is most timely and valuable. For whatever the conclusions, or even if no conclusions are reached, the legal and practical sides of the matter will have been thoroughly aired, and perhaps some useful precedents will have been established.

The Pause in German Electrical Development.

By H. L. Geissel.

From recent indications it would appear that the great boom in German industrial and electrical development has subsided. The *Cologne Gazette,* in a recent number, contained an interesting article on the condition of the electrical industry in Germany, viewed from a German standpoint. It is said that the electrical industry, thanks to the scientific standard to which it has been brought in Germany, now not only takes a leading position in the markets of the world, but also has given a great impetus to the general economic development of the German Empire. Even the competition of the United States, which, in other branches of industry, is being keenly felt, has not been able, in the electrical industry, to run a close race. This must be attributed to the fact that in Germany the highest scientific training goes hand in hand with the most thorough, practical efficiency, and this far outweighs whatever advantages America may possess in the way of production on a large scale. Thus it is that the success of German large and medium-sized electrical companies has so far been highly satisfactory; and that, in this line, which, some fifteen years ago, was comparatively unknown, a large number of enterprises have sprung up, the working capital of which (share capital, loans, reserves), far exceeds the sum of 700,000,000 marks ($140,000,000). The wonderful rapidity with which this industry has developed is further illustrated by the fact that, according to official returns, there were, in 1891, in Prussia, altogether, 794 steam engines, with an aggregate of 39,610 horse-power, exclusively engaged in the production of electric current, whilst up to the first of April, 1899, this number had increased to 2799 engines, with 258,511 horse-power; and at present, doubtless, the 300,000-hp mark has far been passed. To this must be added several hundreds of steam engines which are employed in the production of electrical power as well as for other purposes. With this steady extension, the amount of capital invested in the stock companies of the electrical industries has been proportionately increased. This is due to the fact that, from its very nature, the development of the electrical industry depends, to such a large extent, upon extensive plants with great capacity. The successful carrying out of large undertakings, such as electric railways, electric-power stations, electric-light plants, power-transmission plants, etc., not only calls for large capital, but also requires that, in many cases, this capital be invested without any prospect of immediate return. Very frequently the acceptance of a large order means the investment of considerable capital. The capital required for such orders can be obtained in various ways. In the first place, by the settlement of previous accounts, and the employment of the means thus obtained; or by the extension of credit; or by an increase in the capital stock, or by negotiation of loans. Each of these ways has been extensively followed by leading German electrical companies, and the result has been that most of them have availed themselves of the services of so-called financial companies, which place their capital at the disposal of the former, or secure new capital, as required. This, together with the high scientific and technical ability employed in the German electrical industry, has rendered it possible to secure a leading position in foreign markets, and has, at the same time, brought about the increasing concentration of large capital in this branch of industry, which, even during the present year, has made still further progress. Contrary to the condition in other branches of industry, which, owing to high rates of interest, were compelled to keep their expenses as low as possible, the call for capital by the electrical industry upon the money market, is, as will be seen from the following table, continually increasing. During the first six months of the present year, electrical companies have entered upon the emission of new shares and obligations as follows:

	New shares in million marks.	New obligations, in million marks.	to be repaid at
Hamburg Electric Works	4	..	...
Siemens & Halske, Berlin	9.5	10	103%
Union Electric Co., Berlin	6	10	103%
Berlin Elec. Works	..	12	100%
Co. for Elec. Enterprises, Berlin	..	15	101%
German Co. for Elec. Enterprises	..	10	103%
Elec. Light & Power Co., Berlin	..	10	104%
Helios, Cologne	..	6.2	102%
Silesian Elec. & Gas Co	..	4	103%
Rhenish-Westphalian Elec. Works	1.25	..	...
	20.75	77.2	

From these figures it will be seen that the total increase of the capital of these companies amounted to 97.95 million marks; if to this be added the increase in capital of the Schuckert Company of 14,000,000 marks, which, although decided upon in 1898, was not carried out until the present year, the total increase exceeds 100,000,000 marks. The *Gazette* adds that the new Schuckert shares, or at least the greater part of them, have been used for the purchase of shares of the Continental Company for Electrical Enterprises, thus not properly increasing the capital of the Schuckert Company proper. In spite of this, however, the fact remains the same, namely, that the German electric industry has, within the first six months of the present year, already absorbed more than 100,000,000 marks, say $24,000,000, and in this amount the new formations of smaller electric compaines are not included. At the present time there are at least 800,000,000 marks (about $200,000,000) invested in joint stock companies in the electrical industries of Germany, whilst in 1896 the amount did not exceed 240,000,000 marks. When considering this extraordinarily strong tendency towards expansion, the question involuntarily arises, whether the electric companies will be in a position to continue carrying on a profitable business. In this respect it must, however, be said that up to the present time the financial results of the companies have been, as a rule, satisfactory. The average dividend paid last year by the companies was 9.3 per cent. Nevertheless, some companies showed a slight decrease in their profits, as, for instance, the Union, the Silesian Electric Company, etc., whilst an increase in the dividends was not shown by any company. On the other hand, however, it is almost daily evidenced that there are still large opportunities for the electrical industry, at home as well as abroad. Therefore, so far, no reason exists to fear anything in that respect. Less favorable are, however, the prospects of the competition of the electric companies among themselves. The competition has assumed such proportions that, if it continues on the same scale, it doubtless will have a detrimental influence upon the electrical industries. It would, therefore, be to the economic as well as the national interest of these industries to find means and ways by which this drawback could be overcome.

That this state of affairs exists, and that it ought in some way to be changed for the better, says the *Cologne Gazette,* is well understood and acknowledged in leading circles of the industry. It should also be borne in mind that if a solution in this respect should be found, capital would again flood to the industry. During the last two years there has been a certain restriction in this respect. Whilst up to that time electric shares were in steady demand, and to a certain degree played a leading role at the Bourse, they then began to fall more and more into the background, and last year they fell down and down again, whilst all other industrial shares continued to rise steadily.

The following table is the best proof of this state of affairs:

	1899.		1900.			
	Dec. 31.	Feb. 1.	M'ch. 1.	April 2.	May 1.	June 1.
Siemens & Halske	178,00	177.75	178,00	176,80	176,00	171,00
Schuckert	227,60	232,25	233,00	220,50	212,00	213,40
Ges. für Elektr. Unternehm.	159,75	151,80	152,90	151,80	147,50	139,00
Berl. Elektr. Werke	216,50	213,75	209,75	213,50	210,50	204,80
Helios	165,75	153,80	157,75	155,60	158,80	155,60
Union	171,30	159,10	160,25	161,25	154,00	137,50
Hamburgische Elektr. Werke	148,90	152,90	150,75	152,80	150,50	147,75
Lahmayer & Co.,	163,60	165 25	170,30	163,75	158,50	155,30
Cont. Ges. f. Elektr. Untern.	115,00	115,25	116,00		107,00	106,50
Actien-Ges. f. Elektr. Anlagen.	103,75	102,00	100,10	98,80	95,00	90,25
Elektricität Kummer	159,50	150,00	150,50	148,25	142,50	133,50
Elektr. Werke Liegnitz	75,50	75,50	74,00	76,00	73,75	
Electra Dresden	99,25	98,00	96,80	95.75	93,00	86,25

From these figures it will be seen that the values of the shares of most of the electric companies have fallen since December, 1899.

Wireless Telegraphy in China.

A London despatch from Tien-Tsin, China, says an outfit of Marconi wireless telegraph apparatus has arrived at Tien-Tsin. Were there a wireless telegraph station in Pekin, the crafty Chinese might not be so successful in keeping the world in ignorance of the actual state of affairs in that city.

The Power Transmission Plant at Mescla, France.

A LARGE number of the long-distance power-transmission plants now being put in, are designed for street railway service, and are thus incidentally enabling the accumulation of data that will be found useful when the time comes to deal with sections of converted steam railway. One of the recent interesting installations of this character is to be found in Southern France, in connection with the electric railway which is linking together the towns along the Riviera, from Cannes to Mentone. In this manner, the city of Nice has been equipped with an electric railway system by the French Thomson-Houston Company, of Paris, which has also installed a fine power-transmission plant at Mescla, 18 miles inland, with three sub-stations for Cannes and Monte Carlo.

The Falls of Mescla power plant is shown herewith in Figs. 1 and 2, exterior and interior. The equipment consists of three 500-kw, three-phase generators, each flexibly coupled to a separate turbine. The machines are 20-pole, with stationary armature and internal-revolving poles, with a frequency of 25 cycles per second, and an e. m. f. of 10,000 volts. The turbines are of the centripetal type, with twin conical wheels, receiving the water from two distributors. Each principal turbine is in its own wheelpit of masonry, with strainer, gate, regulator of the Echer Wyss oil-pressure type, etc. For excitation purposes, there are two small direct-current, four-pole machines, driven separately by two 60-hp turbines. Current is taken from the machines to a switchboard which comprises seven panels, three for the generators, one for the exciters, one station panel, and two for the outgoing circuits. There are the usual instruments, and for the line, automatic circuit-breakers, lightning arresters, etc.

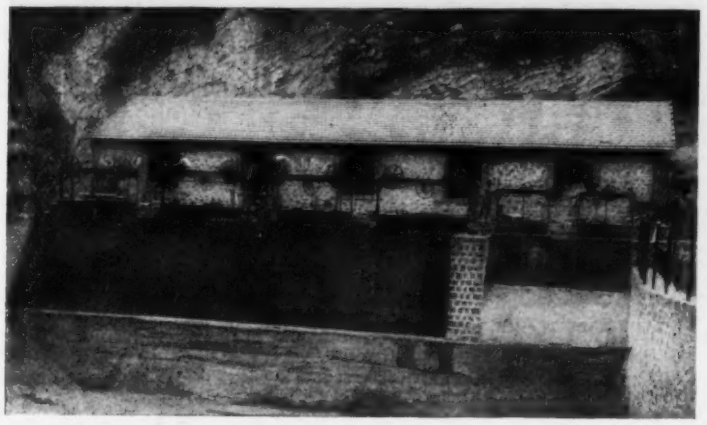


FIG. 1.—EXTERIOR MESCLA POWER HOUSE.

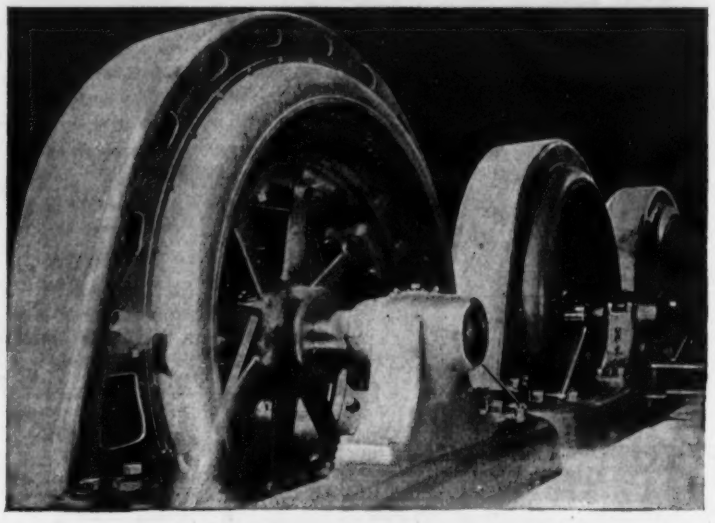


FIG. 2.—INTERIOR MESCLA POWER HOUSE.

As the views herewith indicate, the aerial line construction was a work of no ordinary difficulty. It follows the Valley of the Var part of the way, and much of the route is through mountainous gorges. It consists of six copper circuits, each wire being 7.25 mm. There are two distinct, three-phase circuits operating together under normal conditions, but in an emergency, if one line should be cut out, the other will carry the necessary current. The line is supported on triple-petticoated insulators, and the poles are of iron latticework, from 35 ft. to 40 ft. high, fixed in masonry bases from 5 ft. to 6½ ft. deep, and separated about 110 to 130 ft., according to conditions. In some of the ravines, as shown, resort was necessary to brackets of a special form, whereon the power circuit is carried with the governmental telegraph and telephone lines, with a distance between them of 4 ft. 10 ins. In such places, and wherever risk is incurred, the line is furnished with a protective circuit, intended to hold and put to ground any high-tension wire that might break This circuit, which is itself grounded, is composed of six galvanized steel wires, stretched above and below the power conductors and united every 16 ft. by a transverse wire, thus constituting a kind of open basket-work screen through which the power line runs. As already noted, there are lightning arresters at the ends of the circuits, and the pole line is also protected against atmospheric discharges by lightning rods, grounded at frequent intervals. A telephone line also extends from the Mescla power house to the Sainte Agathe power station. A great deal of this material had to be transported on muleback over rugged mountain paths in small pieces and packages, including, also, at some points, even the water for mixing the cement in which poles or brackets were set. At the Vesubie River, after following the line of the Southern Railway, the line crosses to the Gorge de Balmes in two spans of nearly 230 ft. each.

The transmission system is shown in diagram in Fig. 4. On the 18-mile line between Mescla and Nice there is a drop of 10 per cent. There are, as noted, three sub-stations, the principal being that at Sainte Agathe, where also part of the 9000-volt current is stepped down to 5000 volts and sent to the two other sub-stations, at Californie, for the Cannes street railway, and at Beaulieu, for the Monte Carlo railway. The Sainte Agathe sub-station contains also an auxiliary steam plant which consists of two 700-hp, double-cylinder Corliss engines, belted to the motor generators and taking steam from

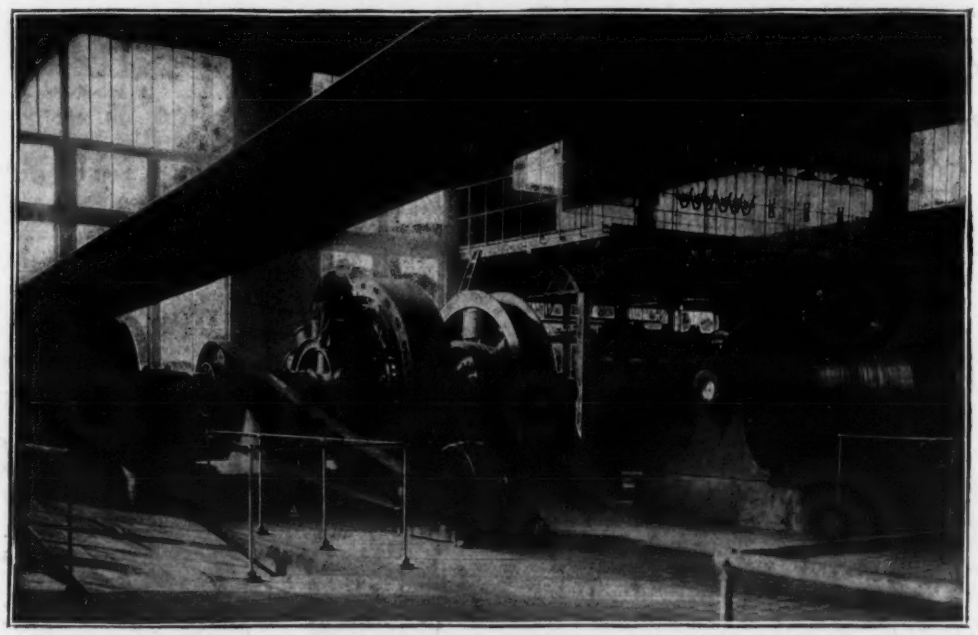


FIG. 3.—NICE SUB-STATION.

two batteries, each of four semi-tubular boilers, the engines running at 100 r. p. m. The motor generators are two in number, and consist of a 530-kw synchronous motor direct connected to a 500-kw, compound railway generator. The synchronous motor receives the current directly from the Mescla line at a pressure of 9000 volts. The generator has an e. m. f. of 500 volts at no load and 550 volts at full load. The speed is 300 r. p. m. The four-pole exciter for the motor, shown belted to the common shaft, is a 25-kw, 60-volt machine turning at 1100 r. p. m. There is one for each group of motor generators.

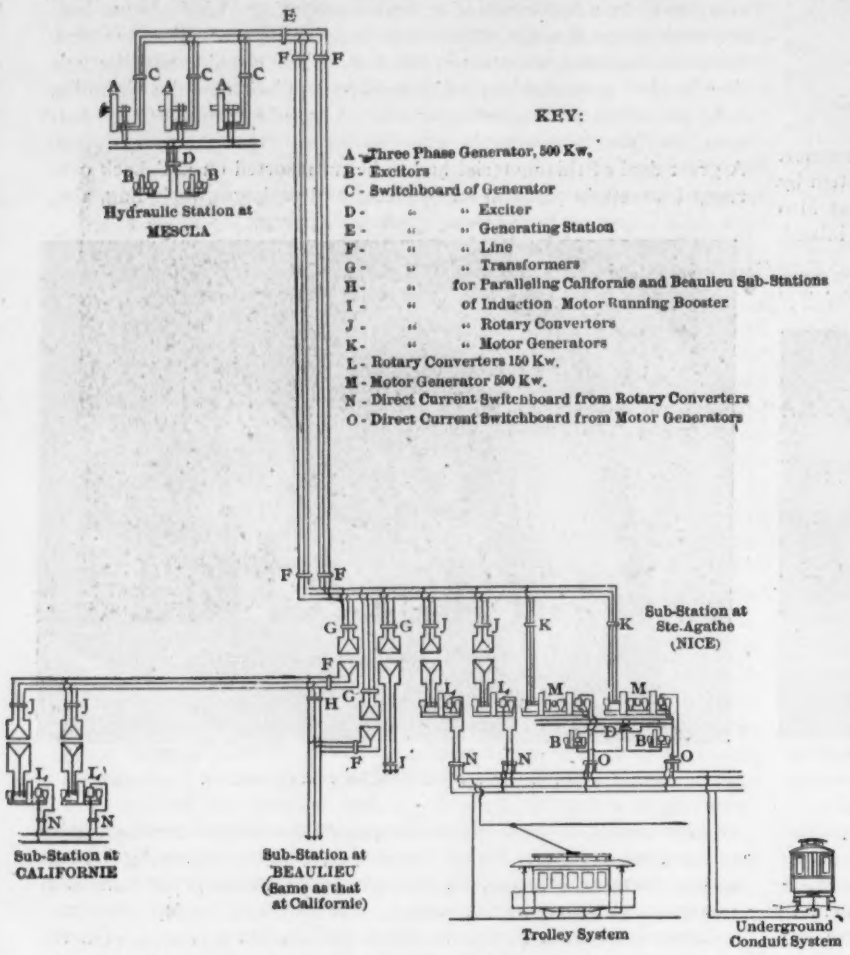

KEY:
A - Three Phase Generator, 500 Kw.
B - Exciters
C - Switchboard of Generator
D - " " Exciter
E - " " Generating Station
F - " " Line
G - " " Transformers
H - " for Paralleling Californie and Beaulieu Sub-Stations
I - " of Induction Motor Running Booster
J - " " Rotary Converters
K - " " Motor Generators
L - Rotary Converters 150 Kw.
M - Motor Generator 500 Kw.
N - Direct Current Switchboard from Rotary Converters
O - Direct Current Switchboard from Motor Generators
Hydraulic Station at MESCLA
Sub-Station at Ste. Agathe (NICE)
Sub-Station at CALIFORNIE
Sub-Station at BEAULIEU (Same as that at Californie)
Trolley System
Underground Conduit System

FIG. 4—DIAGRAM OF TRANSMISSION SYSTEM.

There are also in this station two rotary converters, for which the required e. m. f. of 340 volts on the alternating side is obtained by means of six static transformers of 20 kilowatts. The three-phase transmission to Californie and Beaulieu at 5000 volts is supplied by six 55-kw transformers in two sets of three each. These lines may either be run separate or thrown in parallel. Three 20-kw transformers reduce the pressure to 110 volts for running a small motor generator. This consists of a 50-hp induction motor, coupled directly to a 35-kw multipolar dynamo. The e. m. f. of the latter at 750 r. p. m. is 75 volts, and it is used as a booster on the line running to Contes. Oil insulation is used in the transformers.

The switchboard, part of which can be seen in the illustration, has altogether twenty-five panels. The arrangement of the instruments, etc., is according to standard practice. All connections are made by insulated cables on special porcelain insulators. The machines are designed for a rise in temperature of 45 degs. C. (113 degs. F.), but will stand an overload of 25 per cent for half an hour, and one of 40 per cent for a few minutes without overheating or mechanical strain. The station is lighted by direct-current, enclosed arc lamps on a 120-volt circuit. The current is obtained by using a 20-kw motor generator to reduce the pressure from 550 volts. This machine has a speed of 875 r. p. m. and is composed of a 550-volt motor direct coupled to a compound-wound dynamo.

The sub-stations at Californie and Breaulieu, whose equipment are identical in all respects, are connected with the Sainte Agathe sub-station at Nice by lead-covered cables running in an underground conduit. These cables contain three wires, each 30 mm² in cross section (between Nos. 2 and 3, B. & S.) which transmit the three-phase, 5000-volt current from Nice. The sub-station at Californie is completely installed with two 150-kw rotary converters and six 55-kw static transformers for reducing the pressure of the transmission line from 4300 to 340 volts. The rotaries have a speed of 750 r. p. m. and are 10 per cent over compounded. The switchboard has five panels, four of which are shown in the diagram. The one omitted is the line panel. The feeders are nearly all underground. About the only exceptions are along the Contes line and for a short distance from the sub-station at Beaulieu—perhaps 10 kilo-

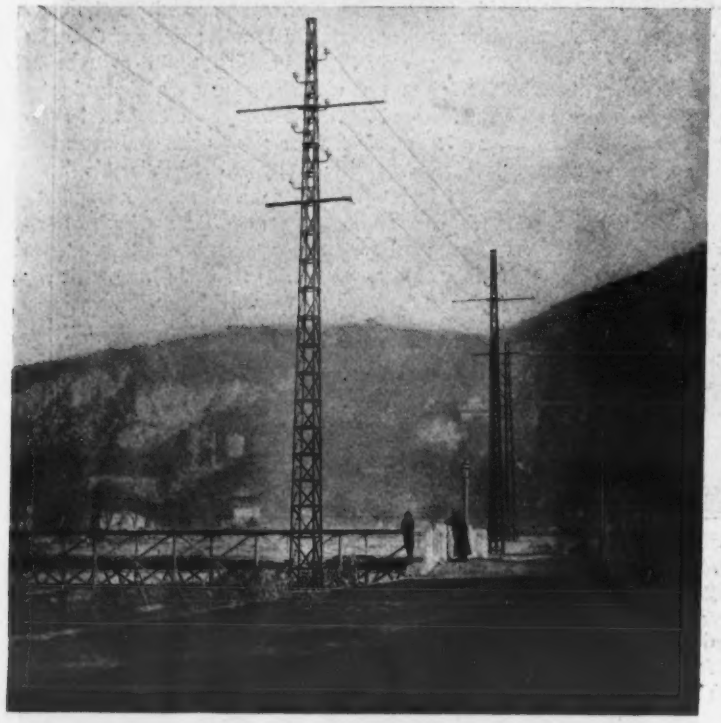


FIG. 5.—POLE LINE ENTERING NICE.

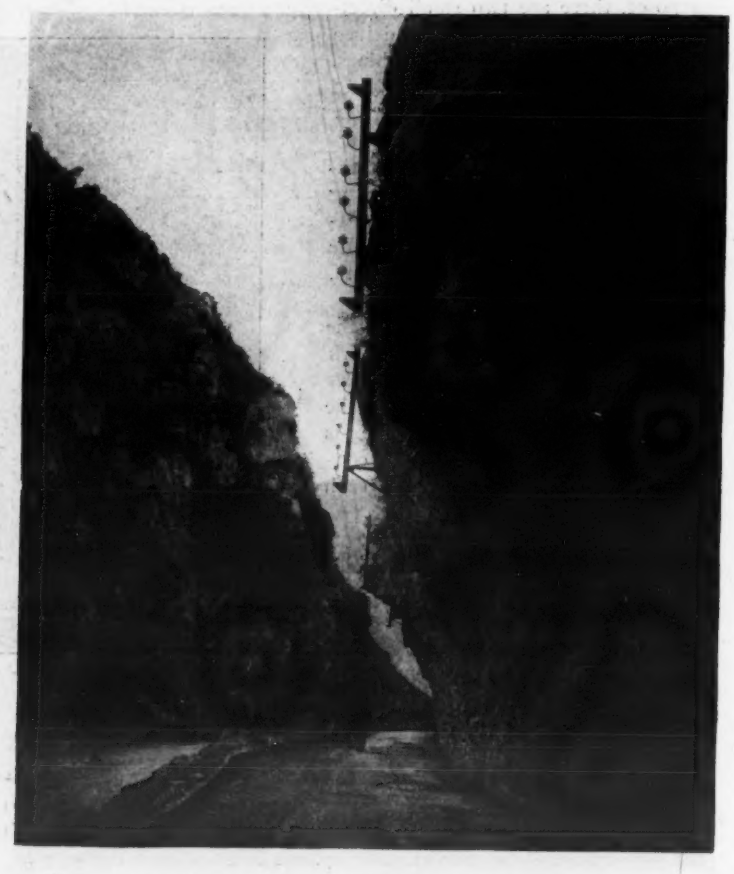


FIG. 6.—BRACKET SUSPENSION IN RIVER GORGE.

meters altogether. These overhead feeders are carried on the same poles as the trolley wire. They are 125 mm² (.194 sq. in.) in cross section. The underground system is made of armored cable 200 mm² to 400 mm² (.31 to .62 sq. in.) in cross section, which is carried from the sub-station to the points of distribution by the shortest possible paths. In order that the municipal regulations regarding difference of potential between the track and underground pipes may be strictly adhered to, a complete system of voltmeter or "pilot" wires has been designed and connects all the important parts of the line with the station switchboard. All danger from electrolysis is thus practically avioded.

The rolling stock of the system will comprise 100 motor cars, and if the service demands it, as many trailers as necessary. Twenty-two express or freight cars and three electric locomotives will also be used. The motor cars are made in three models; those with but one compartment, those with two, for first and second class, to be used on the interurban line, and special parlor cars. The cars have trolley arms and under-running contacts, so that they can operate over any part of the composite system, slot conduit being employed in the central part of Nice and trolley in the outlying portions.

Electric Power in the Parkgate Steel Works, England.

AT the present time, both in this country and in Europe, steel works of every kind are putting in electrical plants for power purposes, the reports from plants already installed being of a convincing and very satisfactory nature as to the convenience and economy obtained. One of the recent installations of this character has gone into the Parkgate Iron & Steel Company's Works at Rotherham, England, a concern which dates back as far as 1823. The weekly capacity of the works is 1500 tons of steel ingots, 1000 tons of iron and steel plates, 600 tons of iron and steel bars, and about 1500 tons of pig iron. The British Westinghouse Electric & Manufacturing Company, which put in the plant, has extensions in progress, while still others are contemplated.

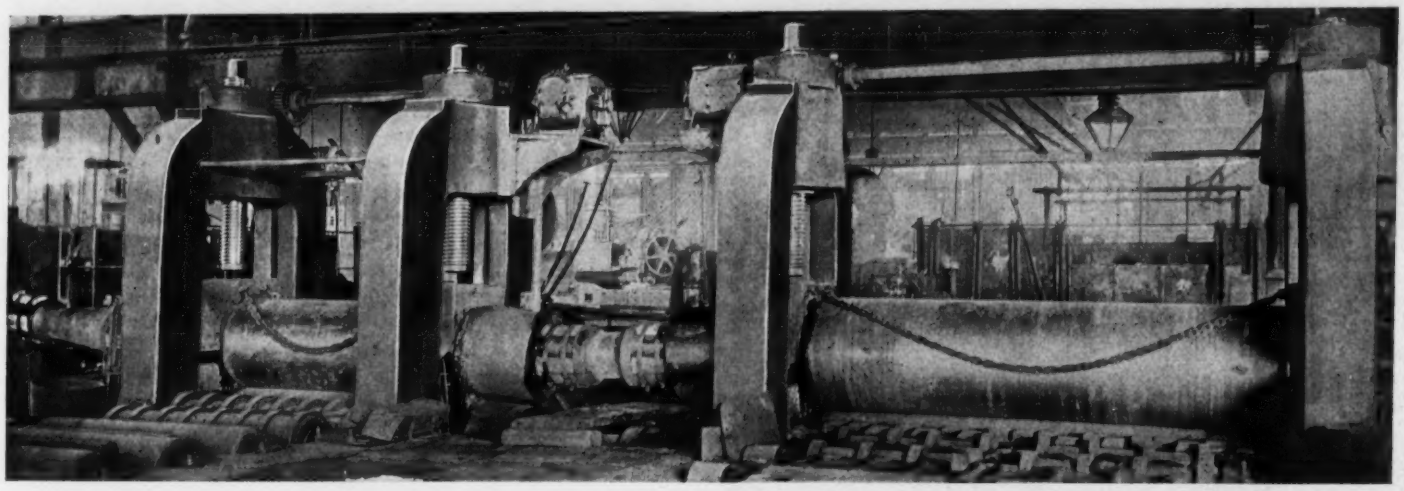


FIG. 1.—PARKGATE WORKS, ELECTRICALLY-OPERATED LIVE ROLLS, AND MOTORS FOR LIFTING AND LOWERING ROLLS.

A view is shown of the power-house interior, Fig. 3. The house is separated from the mills and melting house, and is a substantial brick building. The building was originally the hydraulic engine house, but it has been extended to make room for the electrical machinery. At present the hydraulic pumps occupy one-half, and the electrical generating sets the other half of the building. These sets comprise two

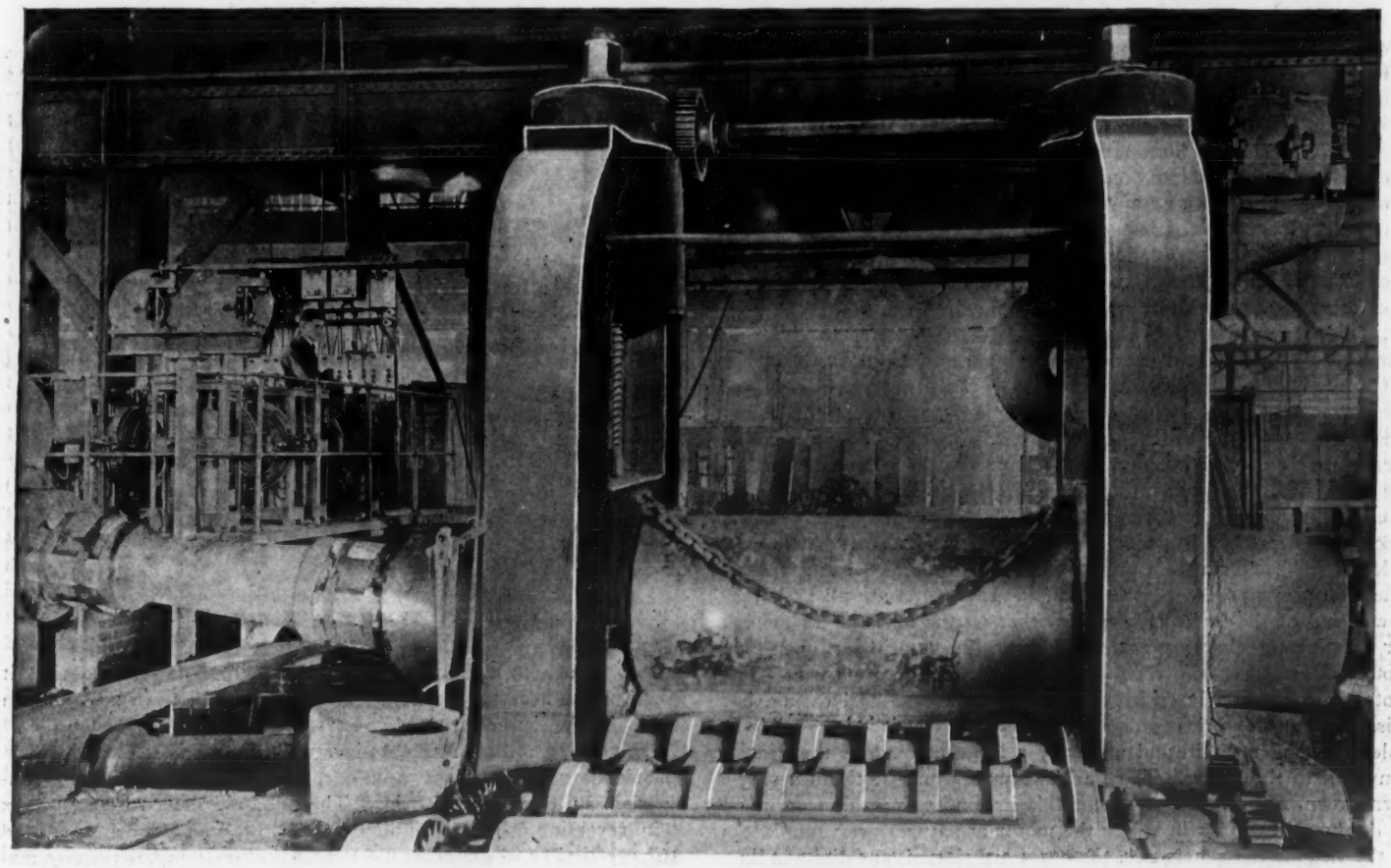


FIG. 2.—PLATE MILL, SHOWING MOTOR FOR LIFTING ROLLS, WITH CONTROLLERS, AND THE OPERATOR'S PLATFORM.

Westinghouse steam engines, direct connected to two 200-kw, Westinghouse, engine-type generators. The engines are of the compound vertical type, and have cylinders 16 ins. high pressure, and 27 ins. low pressure in diameter by 16 ins. stroke, and make 250 r. p. m. The dynamo output at 250 volts pressure is 1000 amperes. Steam is supplied by two 300-hp, Lancashire boilers at 160 lbs. pressure. The dynamos are eight-pole machines, compound wound, and of the open type. The winding of the armature is composed of copper bars, inserted into slots in the periphery of the core, the ordinary practice of

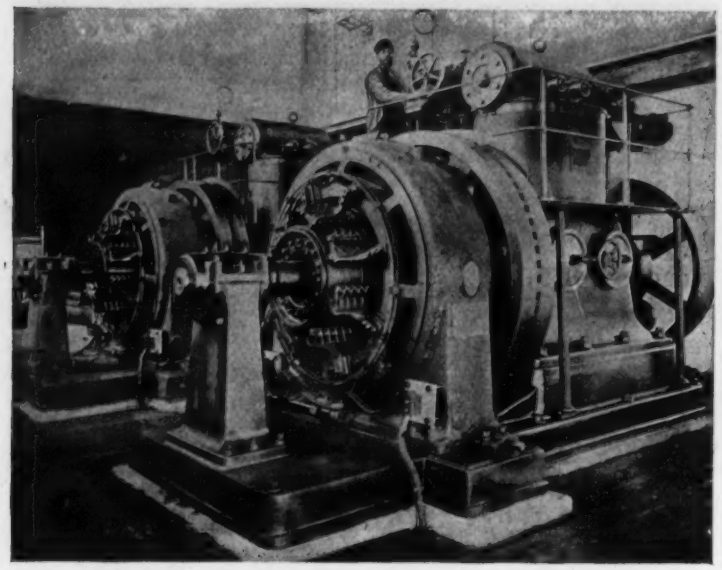


FIG. 3.—POWER HOUSE, PARKGATE WORKS.

the Westinghouse Company for this class of machine. The brushes are of carbon, copper coated, and are held in radial adjustable holders. The generating sets are in duplicate. Space is left for a third set. The switchboard is placed centrally between the two generators, and is of the Westinghouse standard type, consisting of two generator panels, one load panel and one single and one double-feeder panel. Of these feeder panels, one is for the cogging mill, taking 600 amperes, and the two others are for the plate mill and melting furnaces, taking 400 amperes each. Current is delivered from the board not only for power, but for lighting circuits.

The melting house at Parkgate is an excellent example of the modern English steel works plant. The first application of electricity that strikes the eye is a 15-hp motor bolted to and driving the dolomite pug mill for grinding the dolomite used in the basic furnaces. The motor is of the compound-wound, dust-proof type, and runs at 600 r. p. m. The application of a motor to a pug mill where the atmosphere must always be more or less dusty, is a rather severe test for cool running. The open-hearth furnaces are provided with the Wellman open-hearth charging machines. These machines are now familiar to most steel works managers, but they attained only a limited success until electricity became available as a motive power. In those at Parkgate all the movements are electrical, except locking the charging bar to the boxes. The machine consists of a main carriage with box columns at the four corners, supporting a framework of channels which extend almost to the furnace front. This channel framework carries rails on which runs on four wheels the charger truck. From the truck projects downwards a strong bracket carrying a trunnion sleeve which holds the charging bar. There are four motors to the machine, all worked by one operator, for whom a platform is provided at the back, carrying the controllers and their operating levers. The motors for producing the requisite movements are all 25 horse-power and of the series type, except that on the operator's platform for twisting the charging bar, which is a 5-hp, multipolar, open-type motor. Here, of course, the motors are subjected to great heat. The motors are covered in entirely by means of a cast-steel casing, but this, when much work is going on, gets so hot that it is impossible to hold the hand upon it, and naturally a large amount of the heat is conveyed to the motor. The Parkgate works have not had a single breakdown, and to a large extent this immunity from damage must be due to the manner in which the motor armatures are wound. As in the case of the generators, the cores are slotted, and the winding, after having been "formed" by machinery, is put on and held in place by means of hardwood wedges driven into, and entirely filling up, the slots. The winding must, in addition to this, be of ample proportions, for on occasions the motors have had to take overloads, which try them to the utmost.

The furnace floor is extended longitudinally 180 ft. out, the extension being supplied with a 5-ton Craven electric crane running on gantries. The pig iron, ore and scrap are loaded by this crane into special charging boxes which are drawn by a small locomotive in front of the charging machine and opposite to the charging doors. These charging boxes are 6 ft. long by 2 ft. broad and 1¾ ft. deep, which gives a capacity of 21 cubic ft.

The machine having been brought opposite to the furnace door by the first motor—giving a traveling motion—a second motor—giving a cross transverse motion—operates the charging box, and carries it forward into the centre of the furnace; a third motor enables the operator to move the charging bar up or down like a heavy gun in its trunnion bearing, whilst the fourth motor, giving a twisting motion, rotates the charging bar and thus empties the charging box, the charging bar then returning to its original position. The locking gear for securing the charging box to the charging bar is both simple and ingenious. The bar is hollow and its interior is occupied by a steel rod operated from the platform. When the front end of the charging bar has been lowered into the socket of the box, the operator, by means of a lever, pushes the locking bar forward, which catches in a recess in the socket of the box; a reversal of the process releases the box. As stated above, the motors for these movements are all 25 horse-power except the 5-hp motor for twisting; but as the maximum effort is seldom required in any movement, and as they are successive and not concurrent, 25 horse-power may be considered the maximum power used at any one time. Current is provided by two bare overhead copper trolley wires. The increase in output due to the use of this apparatus electrically driven is figured out at 11 per cent.

We come next to the cogging and slabbing mills, where a complete electrical equipment has been laid down, everything being driven electrically that can possibly lend itself to the purpose. Such machinery comprises live rollers for the rolling mills and shears, the lifting and lowering gear of the rolls themselves, the hot saws, etc. In this respect the Parkgate works are said to be in advance of the American works, which have been the pioneers in the use of electricity in steel mills. But nowhere in America, it is said, until within the last few months, have motors been used for driving live rollers, if we except the new plant of the Alabama Steel Company, near Birmingham, and a recent installation of electric live rollers to carry the rails to the straightening presses at the Edgar Thomson Works. At Parkgate the management has decided to limit the sizes of the

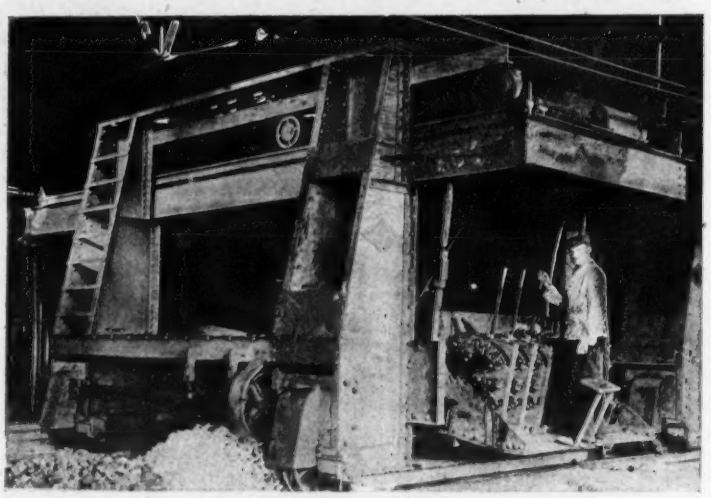


FIG. 4.—OPERATOR'S PLATFORM, OPEN-HEARTH CHARGING MACHINE.

motors in use to two or three standard horse-powers, so that it would not be necessary to keep many different sizes of spare parts in stock. These sizes are 15 and 30 horse-power.

The cogging mill at Parkgate is a 36-in. mill, with rolls 9 ft. long. The slabbing mill is also a 36-in. one, with rolls 7 ft. 6 ins. long, rolling slabs up to 36 ins. x 10 ins. The mills are driven by a 50-in. x 60-in. reversing engine, with almost direct gearing. The motors used are very similar to the ordinary Westinghouse standard railway machines, and are able to give, intermittently in the case of the 30-hp size, upwards of 60 horse-power. As a matter of fact, they are cap-

able of doing even more than this for lengthened periods. The field portion consists of two steel castings, with four inwardly-projecting, laminated, steel pole-pieces firmly held together and bolted to the yoke. The halves are bolted together, the top portion being removable for the inspection of the interior parts. The field coils, armature and commutator are thus completely enclosed, though there is an opening with a spring lid which admits of the brushes being inspected. The care they need is slight, and, placed as they are below the floor level, they are entirely out of the way. At the cogging mill and slabbing mill there are five 30-hp series motors, each driving one set of live roller gearing. The motors are fixed in a pit built into the floor, the top of which is covered by a wooden lid that is easily removed. The motors run at 600 revolutions, geared down by spur gearing to the live rollers at 80 revolutions. The first gear wheel on the motor is a cut gear, the second is a cast-steel gear. One motor runs the set of live rolls on one side of the roll housing; another motor operates the rolls on the other side. For lifting the rolls a 15-hp motor is fixed to a bracket attached to the top of the roll housing. This motor also runs at 600 revolutions, but in this case the gearing is up to the secondary shaft, which runs at 900 revolutions, and engages with the worm making 28 r. p. m. The worm wheel is fixed on the screwed shaft which is attached to the chocks. After rolling, the slabs are carried by live rollers to a steam slab shear. The rollers feeding and delivering from this shear were formerly worked by steam, but the plant is now worked electrically, a 30-hp motor being attached to the feeding rollers and a 15-hp motor to the delivery side. The slab shears are not driven electrically, but the 7-in. x 7-in. billet shears are worked by a 15-hp compound-wound motor running at 600 revolutions, and geared to the fly-wheel shaft, at 200 revolutions, giving a cutting speed of 22 cuts a minute. The hot saw which operates on billets up to 6 ins. square is driven by a 30-hp, series-wound motor.

The main plate mill at Parkgate is a 36-in. mill, with a pair of roughing rolls 7 ft. long, a pair of soft finishing rolls 12 ft. long, and a pair of hard finishing rolls 8 ft. long. The mill is driven by a 50-in. x 60-in. engine, with gearing in the ratio of 3 to 1. In this mill, as in the cogging department, the live rollers are all operated by 30-hp motors, and there are, as indicated above, three sets of housings, with tables on both sides, requiring in all six motors. The skid gear is also operated by a 30-hp motor. The lifting and lowering gear is operated in each case by a 15-hp motor running at 600 revolutions, geared down to 460 revolutions on the secondary shaft. The plate mill wharf is served by a 5-ton electric crane, and also by a 10-ton rope crane, which, however, is shortly to be converted.

One of the best features of the installation is the great ease with which it is controlled and the compactness and small floor space required for the machinery used for this purpose. The Parkgate Works are a case in point. In both the cogging mill and the plate mill the whole control of the live rollers, lifting gear, skid gear, shear rollers, hot saws, etc., is exercised from a raised platform or pulpit close to the roll housings, and commanding a full view of the whole of the mill.

The whole operations of the mill are practically in the hands of one man on the pulpit, although two may advisably be employed. The position of the controllers is seen in one of the cuts, Fig. 2. The current for the various motors is supplied from a distributing switchboard, each motor having a double pole switch and fuse block of its own. The controllers of the motors are of the commutator type, and are designed in such a way that it is possible to start in either direction by moving one lever only, the forward or backward motion of which determines the direction in which the motor is to run. In the central position no current passes, and the motor is at rest. The regulators themselves consist of ironclad resistance drums fixed in a cast-iron frame. The front is provided with a stationary commutator arrangement with the different contacts fitted with replaceable copper tips. A four-armed spider is pivoted concentric with this commutator, each arm being provided with an insulated collecting brush, which can, on being revolved, impinge on the faces of the commutator. The brushes are fitted with magnetic blow-outs. By the side of the operator is an indicator, which enables him to lift or lower the rolls, as may be required, and to work the live rolls in synchronism with the lifting and lowering gear.

In addition to the power plant above described, the whole of the works are now lighted electrically. There are a great number of incandescent lamps, as well as arc lights, generally of the Jandus enclosed or open type. The roll turning lathes and other tools in the fitting shop are operated by two 30-hp motors, the "group" system of driving being employed instead of having a separate motor on each tool. There is a stone breaker in the works, used for slag, which is electrically driven, and a brick-making plant has been recently erected near the steel works with the pug mill and brick press, which are each operated by 30-hp motors. The press has a capacity of 10,000 bricks a day.

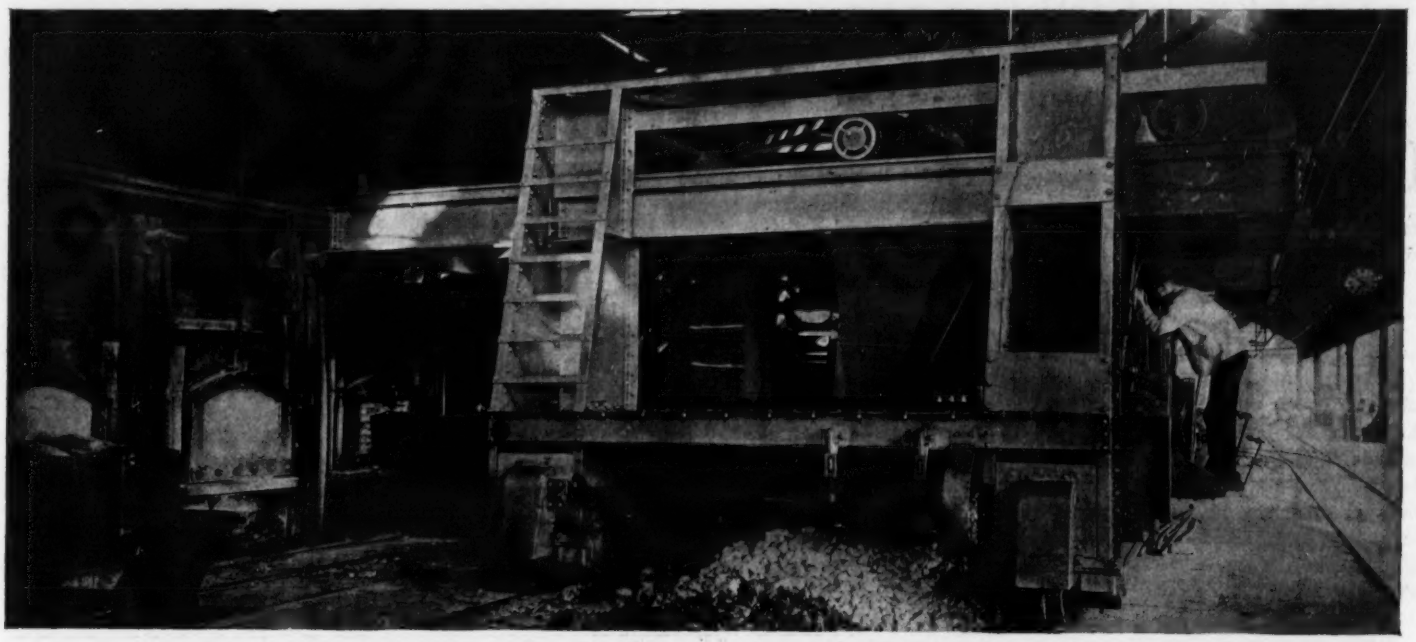


FIG. 5.—ELECTRICALLY-DRIVEN, OPEN-HEARTH CHARGING MACHINE.

It is understood that a number of English steel concerns are ready to adopt electric power, and that Bolckow, Vaughan & Company have already placed with the Westinghouse Company an order for a plant which will be the largest of its kind in the world.

Electrical Congress.

The International Electrical Congress which is to be held at Paris is to meet at 10 a. m. on Saturday, Aug. 18, at the Congress Hall, near the Alma Bridge, in the Exposition grounds. Later meetings will be held at the well-known scientific headquarters, 44 Rue de Rennes. Member's cards will give free admission to the Exposition while the congress lasts,a period of probably eight days, until Aug. 25. A long programme has been sketched out, covering every topic of interest to electrical engineers and physicists. The secretary is Paul Janet, 14 Rue de Stael, Paris.

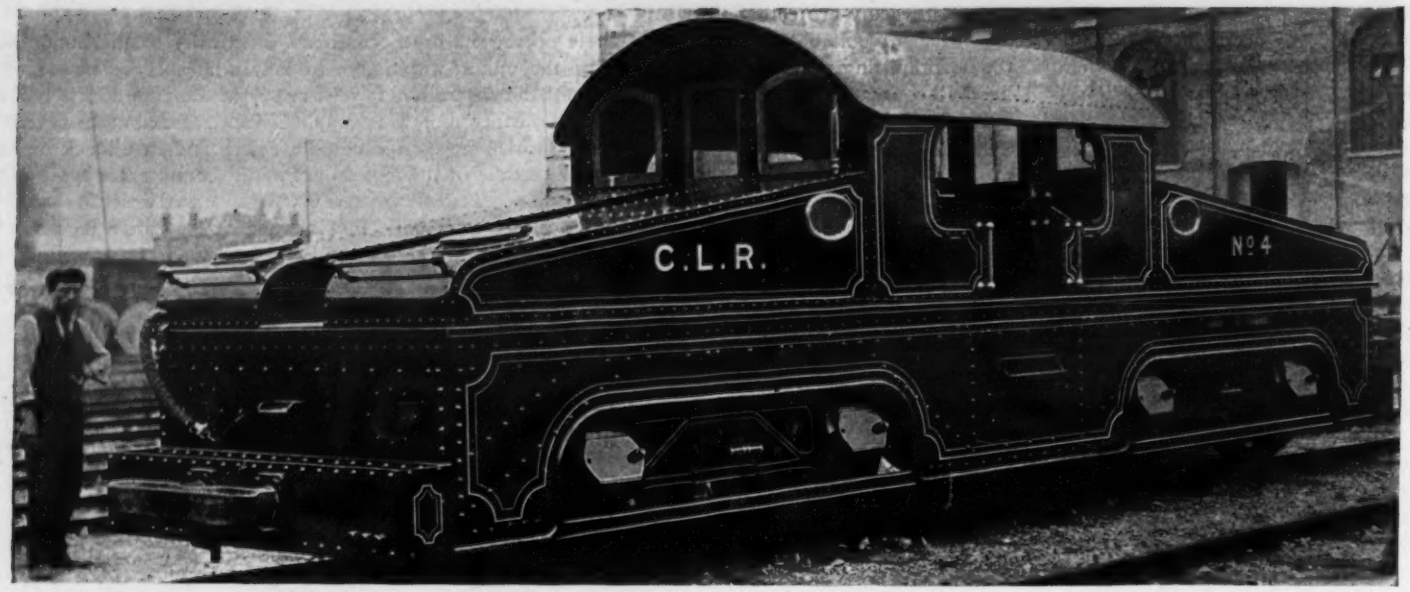


Fig. 1.—Electric Locomotive, Central London Railway.

The Central London Underground Railway—III.

(Concluded.)

IN the two previous articles, the power plant and the sub-stations of the Central London Underground Railway have been dealt with. We come now to the delivery of the current from the sub-station to the track, and to the locomotives. There are also other important, incidental features to be dealt with.

THE THIRD RAIL AND TRACK RAILS.

Leaving the sub-station by the positive feeders, the current reaches the third rail. This is of special mild steel. The rails vary from 30 to 42 ft. in length and weigh 85 lbs. per yard. The resistance of the rail is 4.94 microhms per cubic inch at 20 degs. C., or 7.3 times Matthiessen's standard for annealed copper (1.72 microhms per cubic centimetre at 20 degs. C.). The total length of third rail (including the incline to the mouth of the tunnel at Shepherd's Bush and all sidings) is about 12.6 miles. This corresponds to a total weight of 840 tons. It is quadruply bonded throughout with Crown bonds. There is an insulating support every 7½ ft., or a total of about 9000 insulators.

For the main track lines in the tunnels, a bridge or U-shaped type of rail is employed, weighing 100 lbs. per yard. At the crossings and points, "bull-headed" type is used for ease of construction, weighing 100 lbs. per yard; while for shunting sidings, car sheds and all work above ground, a flange type of lighter construction is employed.

LOCOMOTIVES.

The locomotives are shown in perspective and section. They each have eight 42-in. wheels, and are fitted with four 117-hp motors; that is, one motor to each axle. The motors are directly mounted on the axles, thus saving all gearing, and will be considered later. The body of the locomotive consists of a heavy steel girder framework, on which is raised an iron structure constituting the driver's cab and the forward and backward sloping protections for the apparatus. There is a flooring of wood the entire length of this framework, and on this are placed the controlling device and sundry other mechanism. The whole of this body rests on two bogies, which are free to swivel on turnplates, and measures 26 ft. 7 in. long by 7 ft. 8 in. wide. On each end there are buffers, making the total length over all about 30 ft.

The bogies have each two motors mounted rigidly on their frames, the only springs there are being introduced between the bogie frame and the turnplates on which the body of the locomotive rests. The

Fig. 2.—Double Tunnel, Track, Circuits, etc., Central London Railway.

distances between centres of the wheels of these locomotives is 5 ft. 8 in., thus permitting of going round sharp curves, while the total length of wheel base is 20 ft. 4 in.

The part immediately over the bogies is occupied by the resistances used in starting and regulating the motors, while the centre of the locomotive is devoted to the driver's cab. From this arrangement it will be seen that both ends of the locomotive are identical; it may be

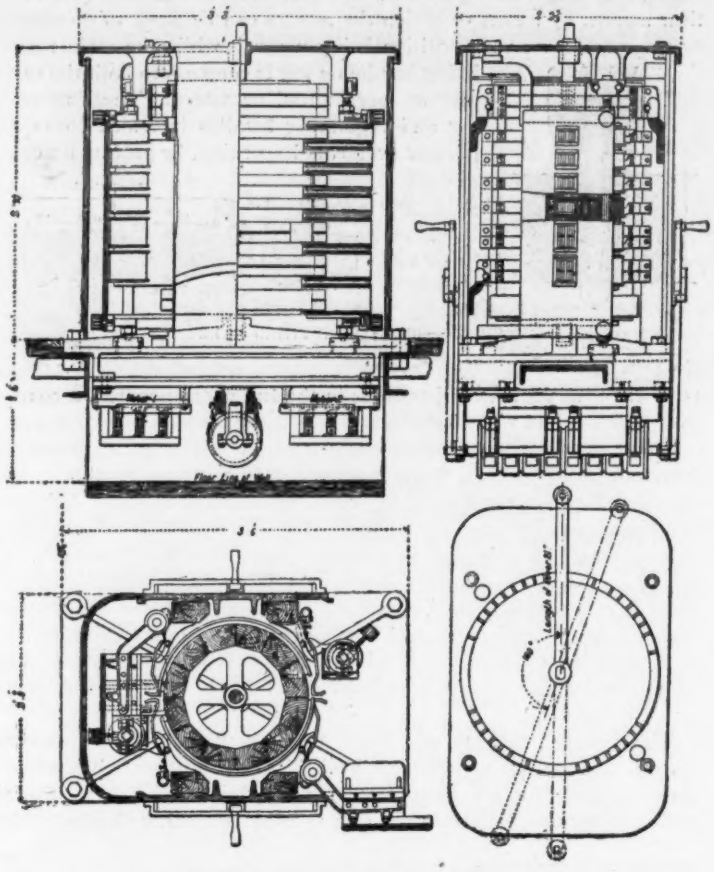


FIG. 3.—DETAILS OF CONTROLLER.

driven in either direction at will, and the lookouts afford an excellent view, both ahead and behind.

The current is collected from the third rail by means of two cast-iron shoes, which rub along it, and is led through an automatic circuit breaker and switch to the controller, and thence to the motors, returning to the track rails through the wheels.

This motor controller, by means of which the speed is regulated, is placed in the centre of the driver's cab. The instruments, a Weston

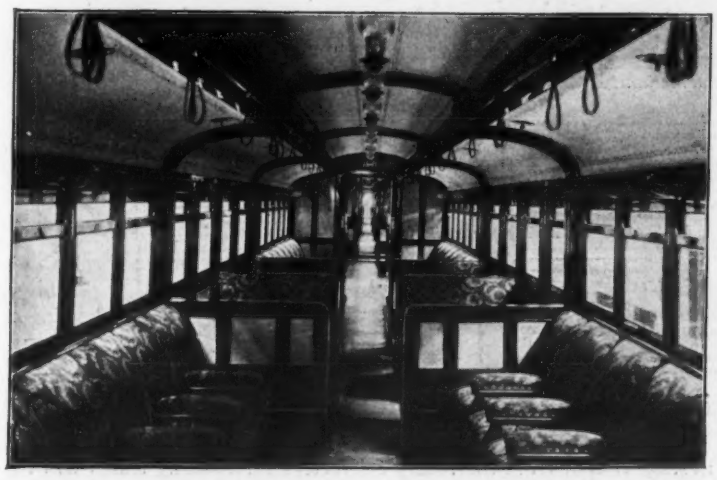


FIG. 4.—INTERIOR OF CENTRAL LONDON CAR.

ammeter and voltmeter, with pressure gauge for the brakes, etc., are placed in duplicate at both ends of the cab, in clear view of the driver, so as to allow of the locomotives being driven in either direction, as already mentioned. In one corner of the cab there is a little series motor which drives a set of air-compressor pumps to fill the air reservoirs, from which Westinghouse air brakes are operated. This motor is fitted with a device to start and stop automatically as the pressure of air in the reservoirs gets below or above the working mean of 80 lbs. per square inch. The reservoirs are situated close to

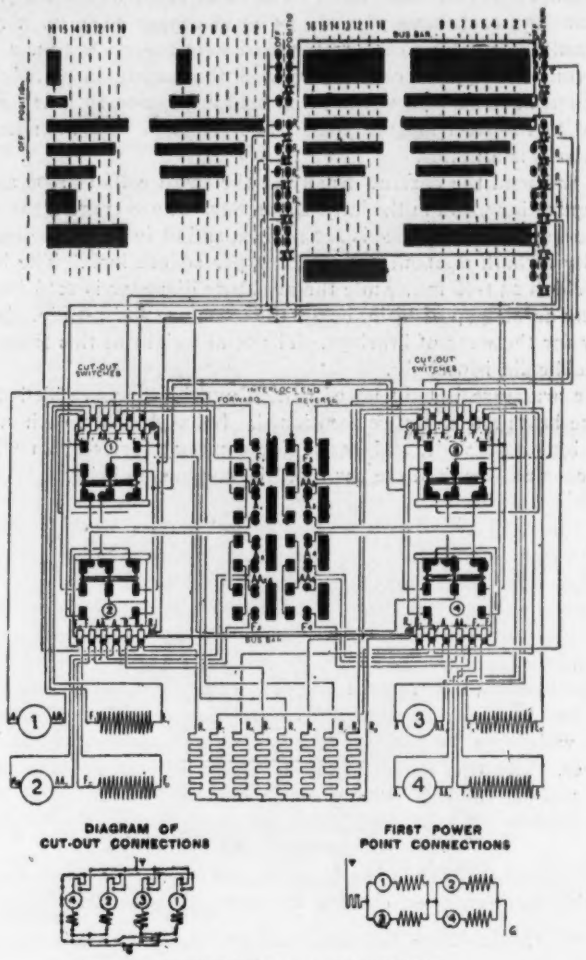


FIG. 5.—CONNECTIONS OF CONTROLLER.

the resistances, and warning whistles are operated from the same.

As will be seen from the drawings, Fig. 7, the locomotive is iron-sheathed, thus having a very compact and neat appearance. The resistances are, at the same time, well ventilated, to keep them as cool as possible in working. The total weight of the locomotive is 97,000 lbs., and it is capable of exerting a draw-bar pull of over 30,000 lbs.

MOTORS.

The motors, which are series-wound, 500 volts, 117 horse-power,

FIG. 6.—SINGLE TUNNEL.

as already mentioned, are mounted directly on the axles of the locomotives, and for this purpose the armature is built up on a brass sleeve, into which the axle is afterwards forced. The case also forms the yoke of the magnetic circuit, and is made of high permeability soft cast-steel, in two halves, so arranged that when in place the

lower half can be dropped to expose the armature for examination. This steel yoke has four laminated magnet cores and pole-pieces bolted to it internally, and is rigidly fixed to the bogie frame, which carries the bearings. All the magnet cores are wound, two having large coils and two small ones. The large coils, which are situated horizontally, each have 76 turns of strip copper 2.125 in. x .11 in., the small ones having each 15 turns of strip copper .875 in. x .22 in. The coils are wound on formers and thoroughly insulated before being put in place, afterwards being held in position by brass castings bolted to the steel magnet yoke. The principal insulation used for these coils is asbestos.

At full load the current density in the small coils is 1000 amperes per square inch, and in the large spools 820. The average cross-section of the steel case and poles is 240 sq. ins., and at full load the magnetic density in both is about 102,000 lines per square inch. The bore of the field is 23 1-16 ins., while the armature diameter is 22½ ins., thus leaving an air-gap of ¼ in. below the armature and 5-16 in. above, to allow for the wear of bearings. The total weight of this frame, with the field coils, is 9000 lbs.

The armature is built up of slotted punchings, assembled directly on the brass sleeve before mentioned. It has 61 slots, each 1.73 ins. deep by .52 in. wide, and has a single-curcuit series-drum winding. The construction is of the bar type, the conductors being .6 in. x .1 in. There are six such conductors per slot, making in all 183 total armature turns. The current density at full load is 2100 amperes per square inch. The winding is held in place by hickory strips and steel binding wire. The magnetic density at full load in the armature teeth is 127,000 lines per square inch, and in the core below the teeth 86,000 lines per square inch. The commutator is 19 ins. diameter and has 183 segments, or one per turn; it is 8 ins. long and has two sets of carbon brushes, four in each set. The commutator segments are held in place by steel, core-shaped rings being insulated therefrom by mica which are mounted directly on the previously-mentionad brass sleeves. The total weight of this armature, without shaft, is 3000 lbs., thus making the total weight of the complete motor 12,000 lbs., approximately.

CONTROLLERS.

Control of the motors is effected by the series-parallel arrangement. By this method, when starting the motors, instead of introducing a large amount of resistance in series with each motor to reduce, the voltage across its terminals and consequently the current taken, two motors are placed in series with only a small amount of resistance in the circuit. Thus the energy that would otherwise be wastefully dissipated in the resistances is utilized in the second motor. As the motors run up to speed, first the resistance and then one motor is gradually cut out, and eventually both motors are placed in parallel across the full-line voltage. From this it will be seen that for the same amount of energy consumed, twice the torque may be obtained at starting, with consequently a greater efficiency of the whole plant.

In the present case there are two sets of two motors regulated as described, the entire operation being performed by one handle. We show, in Figs. 3 and 5, views of this controller. It is placed, as already mentioned, in the centre of the driver's cab, being bolted to the floor of the cab, and also to the locomotive framework, and stands just a convenient height for operation. On each side will be noticed a vertical handle, by means of which the motors can be made to go ahead or reversed, the centre position being neutral, while the main regulating handle on top is common to both the regulating speed ahead or astern. These reversing and regulating handles interlock so as to prevent accidents happening, by putting on current when the regulating handle is in the full speed position, a condition which would practically amount to short-circuit.

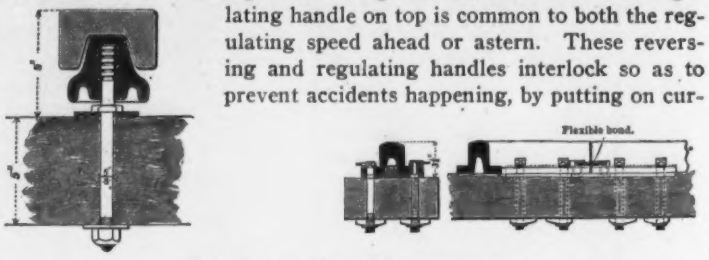


FIG. 8.—DETAILS OF THIRD RAIL.

The contacts of hard copper are carried on a cylinder of specially-prepared wood, which, being revolved into position by the aforementioned regulating handle or lever, makes or breaks the different combinations with other stationary contact fingers which press against this cylinder. A solenoid blow-out is provided at every contact, by which any arcing is instantly blown out. The whole of this arrangement is enclosed in a steel sheathing, the cover having a dial to register the position of lever, and consequently the contact cylinder, according to the amount of power being used or required. The diagram of the various combinations for the different speeds shows 22 stops or variations.

The average current per train, throughout the run (including stops), will be 170 amperes, or probably 180 amperes, when allowance is made for air compressors and lighting. As there are 22 trains in service (allowing for one at each end being shunted), the average output from the rotary converters for running trains will be about 4000 amperes, but the running of the Sprague elevators will probably increase this to an average output of 5400 amperes, or 2700 kilowatts. The output from the rotary converters will, at frequently-recurring intervals, reach a maximum of at least 8000 amperes, or 4000 kilowatts. The losses in transmission, corresponding to the average load of 2700 kilowatts from the rotary converters, will be 375 kw, summarized as follows: High-tension cables, 50; step-down trans-

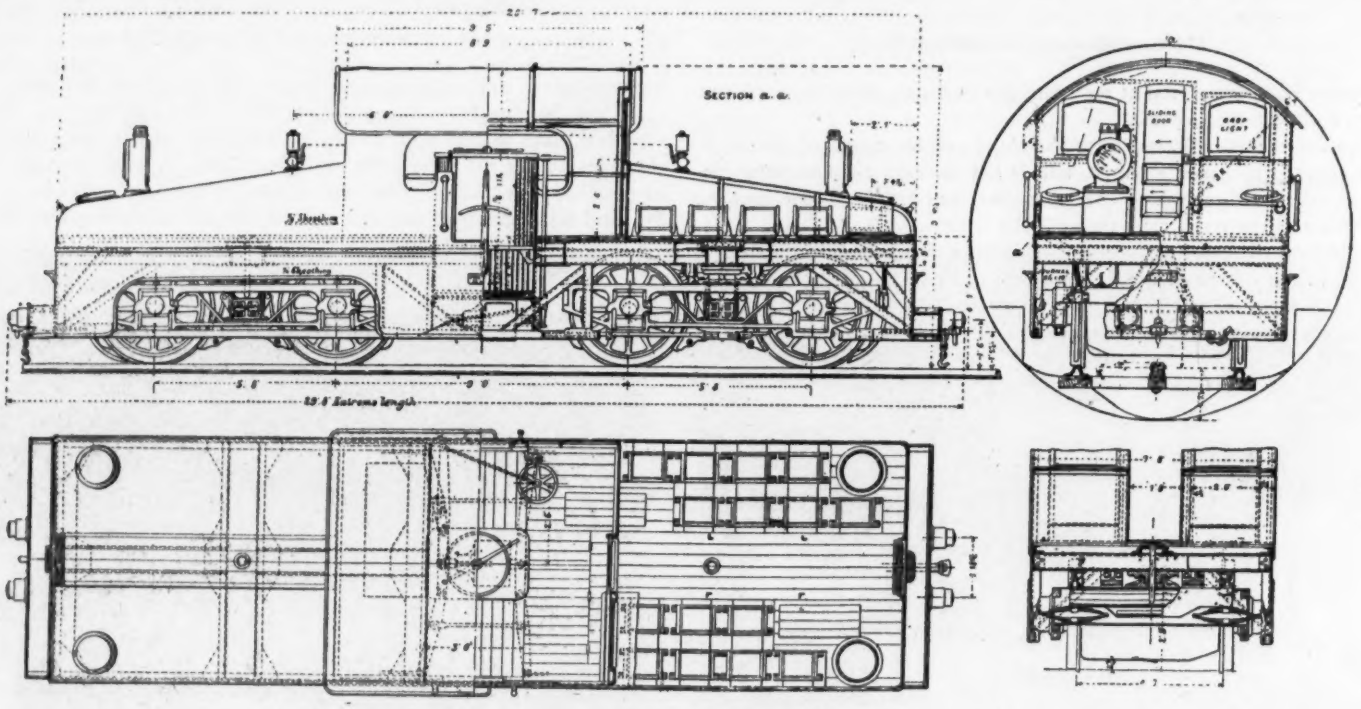


FIG. 7.—DETAILS OF LOCOMOTIVE, CENTRAL LONDON RAILWAY.

formers, 85; rotary converters, 240. This makes an average output at 5000 volts from the central station of about 3075 kilowatts, or 360 amperes per phase.

The efficiency of the 850-kw, three-phase generators is 95 per cent, and that of the engines 92 per cent at the rated output. Hence the combined efficiency is 87 per cent. This required 4700-hp input to the six engines, and as they require 14.5 lbs. of steam per ihp-hour, an evaporation of 68,000 lbs. of water per hour. The exciter sets and lighting sets will increase this to about 75,000 lbs. of water per hour, and at 5 lbs. of water per pound of coal, this will require a coal consumption of 15,000 lbs. of coal per hour, or 134 tons per working day of 20 hours.

PASSENGER COACHES.

The passenger coaches were built by the Ashbury Railway Carriage Works Company, of Manchester. They are 36 ft. long over all by 10 ft. wide, and are hung on two double bogies, one at either end. The interior of the cars is finished in polished woods, and they are built on the central vestibule, or American, style, the passengers alighting from side gates at the end of each car. A flexible iron footway connects all coaches together, allowing a central passage from end to end of the train, while there are sliding end doors to every car. Each car has a seating capacity of 48 passengers, and is lighted with 20 16-cp incandescent lamps, the current for which is taken from the rails through the locomotive shoes. A view of a car interior is shown in Fig. 4.

ELECTRIC ELEVATORS.

The depth of the road beneath the surface has necessitated the use of elevators for handling the passengers. It will be remembered that the road lies at a depth of from 30 ft. to 102 ft. below the surface, and that there are 13 stations. At each of these stations there are two or more entrance shafts, with stairways, and from three to five elevators, depending upon the volume of traffic. For this work no fewer than 48 elevators have been required, and the order for these was given to the Sprague Elevator Company, of New York, and filled some time ago. These elevators are placed in shafts ranging from 18 ft. to 30 ft. in diameter, and the height of lift ranges from 41 ft. to 82 ft. Owing to the conditions, the cars are of unusual and lozenge shape. They are of steel frame, with oak finish, and have doors for both regular and emergency exits. They will carry from 50 to 90 passengers each, depending on the size, and there are five of them at the Bank and Post Office stations, where the heaviest traffic is expected. Five other stations have four elevators each, and the other stations have three each.

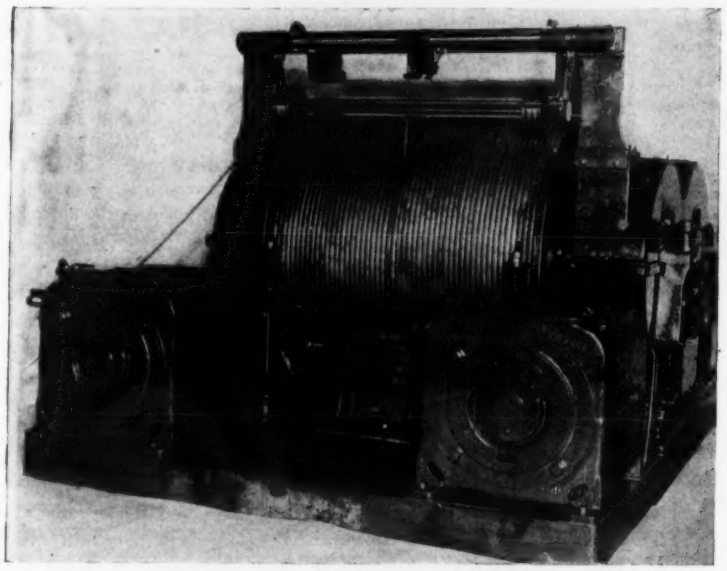


FIG. 9.—ELECTRIC DUPLEX TANDEM WORM-GEAR ELEVATOR, CENTRAL LONDON RAILWAY.

The apparatus used is what is called the type "S" duplex tandem worm gear. It is very simple and completely self-contained, it only being necessary to attach the cables and controller wires to operate it. Mounted upon a heavy cast-iron base are two side box-frames, which, besides forming the bearings for the drum and idler shafts, form oil tanks in which the worm and worm wheels and lock gears are enclosed. In line with these casings, bolted to the bed plate and directly connected to the worm shafts, are the motors. These motors are of the four-pole, enclosed railway type. They are shunt wound, ironclad, and take current in series with each other from the feeders and the third rail. By putting the motors in series, the duty on each side of the machine is equalized for all speeds, the combination with a compensating gear arrangement forming an electro-mechanical couple. When running at 470 r. p. m. they give an elevator speed of 200 ft. per minute. When a descending car is loaded, the motors

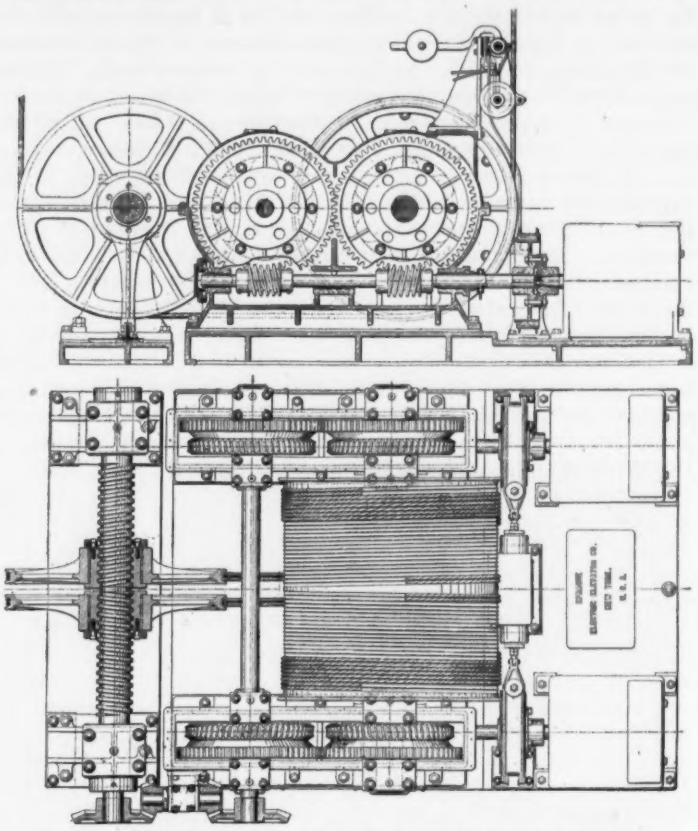


FIG. 10.—SIDE ELEVATION AND PLAN, ELECTRIC DUPLEX ELEVATOR.

generate and return current to the line. This factor is counted upon to materially reduce the total current consumed by the entire system.

The rest of the machine consists of covers for the gears and a slack rope device, consisting of two small loose pulleys mounted upon a pendulum device which holds these pulleys against the hoisting cables close to where they wind upon or off of the drum. In case the cables become slack, for any reason, the pendulum frame swings out under the influence of weights, and springs a switch, thus cutting off the motor current, and also throws on the solenoid brake. In this brake friction pulleys are secured to the worm shafts and are surrounded in part by two rubbing blocks held in close contact with the friction wheels by powerful coil springs. When current is passing through the solenoid contained in the metal box, midway between the friction wheels, the two plunger armatures are drawn in, the toggles straightened out and the brakes lifted. Any interruption of the current at once releases the armatures and allows the springs to throw on the brakes. This arrangement avoids the possibility of accident due to the breaking of a wire or the interruption of the current supply.

Each motor drives a shaft upon which is securely doweled a right-hand and a left-hand worm, which mesh with two worm wheels, one mounted upon the drum shaft and the other upon the idler shaft. There are also bolted to the worm wheels two straight gears, which are larger than the worm wheels, and mesh together. The motors are arranged to run in opposite directions, both running in for raising, or out for lowering. In this way there is no side thrust on the drum bearings, and the usual end thrust, present with the ordinary arrangement of worm and worm wheel, is taken care of by the two worms mounted upon each driving shaft, the thrust of each worm just balancing that of the other. In this way the thrusts and side strains are so nicely balanced that the item of friction, usually a heavy one in this type of gearing, is greatly reduced.

The erection of these elevators for the Sprague Company was carried out under the superintendence of Mr. E. W. Moir, assisted by Mr. G. Rosenbusch. It may be mentioned that the contract for

much of the steel work in connection with the elevator contract was secured by the Carnegie Company.

MISCELLANEOUS DETAILS.

The stations along the line are lit by arc and incandescent lamps, fed from a 500-volt, three-wire system, and as a reserve and precaution against non-supply, three large batteries of chloride accumulators have been installed along the line. The normal charging current for these is 70 amperes, and the booster raises the voltage as required by from 50 to 250 volts. As a further precaution against non-supply, the mains for this purpose are kept separate in the two tunnels; the arc lamps in the up-station, and the incandescents in the down-station are fed from the mains in the down-station, and vice versa. The arc lamps are of the Westminster enclosed type. The wiring of the stations and elevators was done with Callender and Henley cables, protected by the lined steel pipes of the Conduit and Insulation Company.

In preceding sections of this article note has been made of the various concerns contributing material, and it will be recalled that the electrical equipment was due to the British Thomson-Houston Company, while the engines were furnished by E. P. Allis & Co. The cars were supplied by the Ashbury Company, of Manchester, and by the Brush Electrical Engineering Company. The line was put down by the Electric Traction Company, Ltd., organized for that purpose.

The engineers to the Central London Railway are Sir Benjamin Baker and Mr. Basil Mott, while Mr. H. F. Parshall, as consulting engineer, designed the whole of the electrical and steam equipment and overlooked its installation. Mr. G. C. Cunningham, formerly of the Montreal street railways, is general manager of the railway; Mr. F. Hudleston is chief engineer and Mr. W. R. Dixon is in charge of the generating plant.

Power Transmission Plans in England.

The committee of the British House of Commons, to which they were referred, have approved the grant of franchise in the case of four out of five power supply schemes submitted this session to the Legislature, thereby overruling a vehement and narrow-minded opposition on the part of many of the municipalities in the areas affected. It is possible under British procedure to renew this opposition when the bills for franchise reach the House of Lords; but it is improbable that this will be done and still less probable that if done it will be effective, and the four power-supply schemes may, therefore, be looked on as practically launched.

The first of these schemes is the County of Durham Electric Power Supply, which covers the south bank of the River Tyne, extending back far into Durham County. The promoters are the Electrical Power Distribution Company, the managing director of which is Mr. William L. Madgen. The British Electric Traction Company, which owns the plurality of the electric street railways in Great Britain that are not under municipal control, is in alliance, and several of its roads will be served under the scheme. The above is an area of large and varied manufactures and corresponds with the Durham coal fields.

The next, the North Metropolitan Electric Power Supply, is of a different character. It begins with the municipal boundary of London and stretches back into the suburbs through Middlesex and Hertford counties for a distance of about 20 miles. The people behind the scheme are the same as in the case of Durham County. This bill was referred to a separate committee from the others, but the decision in each case has been practically identical. It will thus be seen that two out of the four comprehensive power supplies to be first brought out in Great Britain are associated with the name of Mr. William L. Madgen.

The third is the Lancashire Electric Power Company. This deals with a very large and rich region, in fact all the southern sections of Lancashire County. The area embraces a number of populous cities and towns, including Liverpool and Manchester. A number of manufacturing companies are interested in this franchise, the active promoter being Mr. F. E. Gripper, of Edmundson's Electricity Supply Corporation, a company which has secured a great number of electric lighting franchises up and down the United Kingdom.

The South Wales Electrical Power Distribution Company also will serve a populous manufacturing area, practically identical with Glamorgan County, and the South Wales coal and iron country. It has strong support from the local manufacturing companies and part of the avowed objects of the promotion is to enable the industries of South Wales to stand up better against competition from this country. The engineers of the scheme are Messrs. Bramwell and Harris, but Mr. Dixon H. Davies has been excedingly energetic in getting the business through.

The franchise refused is that of the Tyneside Electric Power Company. The engineer of this was Mr. Alan A. C. Swinton and the scheme was backed with an amount of influence that one might have imagined enough to carry anything. Not only were most of the great Tyneside shipbuilding and manufacturing companies behind the bill, but arrangements had been come to with the principal steam railroads for facilities and wayleaves. The action of the committee in refusing franchise in this case, though typically British, has come as a surprise even in England. The committee, according to precedent, gives no reason for its decision, but the facts are alleged to be that the promoters pegged out a small area, having regard rather to their own convenience as manufacturers than to the advantages of the general public. This district trenched on that of the Durham project on the south, and on the north included the area of a smaller power scheme already in existence, which represented the combination of a gas company and one of the electric-lighting companies supplying the city of Newcastle. This last had its bill in Parliament for an extension of its power supply area, and the committee had therefore to decide between competing schemes and presumably the conclusion was arrived at by some such process as the following. A decision in favor of the Durham must be given on the ground that it promised wider advantage to the public and that if the prior rights of the gas company to extend its existing business were respected there would be little or nothing left of the Tyneside Company's area. It is, however, not improbable that a new bill will be brought up next year for supplying so much of the Newcastle district as is already unappropriated. As the rejection is on a point of detail rather than of principle the case seems to have been one for consolidation or compromise between the three companies, but the Tyneside Company standing out in the result has "got left." An interesting feature of this scheme was that it was proposed to use exclusively the Parsons steam turbines of a similar character to those introduced into this country by the Westinghouse Company. As a result of arrangement the extended franchise of the Newcastle-on-Tyne Electricity Supply Company and the Gas Company will go through the Legislature unopposed, and it may almost be ranked with the other power supply bills. The engineer in this case is Mr. C. H. Merz, formerly of the British Thomson-Houston Company.

The decision of the British Legislature marks a change in public opinion of the highest possible importance. From an engineering point of view, an interesting point is that it is proposed in every case to do the whole of the transmission work by cable, and to use British machinery. Just where they are going to get it we shall have to see. At present date all the British factories are so congested that, even in standard lines, it is impossible to get anything within three months of promise and for the work contemplated machinery will be required of a character which is quite new to most British manufacturers. It should also be remarked that though the present bills mark a successful innovation on the usual procedure for obtaining powers of public electrical supply in the United Kingdom, the terms of the franchises will be such that the supply to the consumer will be under the existing government regulations, as administered by the Board of Trade. The work of distribution will in many cases be done by subsidiary or independent companies.

The Roentgen Society.

The Roentgen Society of the United States will meet in New York City, Dec. 13 and 14, 1900, at the Academy of Medicine. Papers have been promised by eminent men abroad and at home, and a successful scientific meeting is assured. There will be offered advantages to the visiting members for instruction in X-ray work that cannot be had under any other conditions. It is especially desired that all hospitals using X-ray apparatus, physicians, surgeons and dentists doing X-ray work, scientific investigators, manufacturers and dealers in X-ray apparatus of all kinds throughout the United States, will at once send their names and addresses to the chairman of the committee of arrangements, Dr. S. H. Monell, 43 East Forty-second Street, New York City, so that they may be sent important notices regarding the meeting. This society is the only one of its kind in America, national in character and for scientific purposes only. J. Rudis Jicinsky, M. D., of Cedar Rapids, Iowa, is secretary. All those wishing to become members or read a paper before the society, should communicate with the secretary.

The Courts of Honor in Electricity Building, Paris Exposition.

THE courts of honor, which have been referred to before in the ELECTRICAL WORLD AND ENGINEER, are located in the central gallery of the Palais of Electricity, between the French and foreign sections. On ascending either of the two gallery stairways in the foreign section of the machinery hall, on the ground floor, one lands directly in front of the United States Court of Honor. Located centrally over the main aisle of Electricity Building, and behind the Chateau d'Eau, will be found the courts of the United States, Germany, Switzerland and France, following each other in the order named, while the courts of England, Hungary and Austria are located to one side—to the right facing the United States Court of Honor, and looking east.

The idea of the court of honor has been differently conceived, or at least differently executed, by the various nations represented here. The United States court contains, as already described in these pages, the relics of the period of electrical invention from the time of Henry's experiments in electromagnetism up to a few years ago, when the fan motor and the enclosed arc lamp appeared, and not a single exhibit of commercial apparatus is found here. The French Court of Honor also contains historical machines, instruments and literature, but the outer sides of the pavilion, in which these are displayed, are made up of booths, in which commercial goods are shown. The Hungarian and Austrian courts also show a number of historical machines and instruments, while the greater part of their space is taken up by exhibits of present-day apparatus. In the Swiss Court of Honor the achievements in electrical and mechanical engineering in Switzerland are illustrated by a collective exhibit of drawings, photographs, maps and models of transmission plants in that country. The two remaining courts, those of England and Germany, contain solely commercial apparatus, but these are arranged in a specially pleasing manner, fixing the attention of technical and non-technical people alike. For the non-technical, for instance, the pavilion of the Allgemeine Elektrizitats Gesellschaft, with its curious wrought-iron ornaments of vines twining themselves to the top of the dome, is an object of great interest, while for technical people, the Nernst lamp illumination within, and the fine display of Lord Kelvin's instruments, in the English court, are of much interest.

The German Court of Honor contains exhibits of the following firms: Allgemeine Elektrizitats Gesellschaft, Siemens & Halske, Hartmann & Braun, Lux'sche Industrie Werke, Kaiser & Schmidt, Dr. Paul Meyer, H. Aron, Voigt & Haeffner, Félten & Guillaume, Schuckert & Co., Edelmann-Munich, and of the University of Goettingen.

The Allgemeine Elektrizitats Gesellschaft has erected a pavilion in stucco with wrought-iron ornamentation, as mentioned before. It has a rectangular floor plan, two of the faces being taken up by entrances to the interior, closed by large, grated iron gates, while the other two are used for exhibition purposes. Four square columns, surmounted by diffusing globes of incandescent lamps, divide each of these two sides into three sections, thus dividing the exhibit into six parts. Starting with the face turned toward the United States Court of Honor, and going around in a clockwise direction, the various divisions show the following exhibits: 1, motors for directly driving machines; 2, portable motors and electrically-driven drill presses; 3, arc lamps; 4, indicators, switches and large induction coils; 5, electric fans and flush switches, and 6, a car axle, with railway motor, trolleys and trolley-line material. The majority of the lighter apparatus is placed on shelves arranged stepwise.

The interior of the pavilion is decorated with frescoes representing views from the company's works, and allegorical pictures representing the electric spark, and one relating to the various forms of electric illumination. The interior is brilliantly illuminated by a large number of Nernst lamps, giving a most satisfactory illumination effect which in color probably resembles ordinary sunlight more than does any other form of artificial illumination.

Siemens & Halske also have a large space in this section, which is divided by passages into five parts. A bust of Werner von Siemens, placed on a pedestal, decorates the main division, as will be seen from our illustration. This division contains an exhibit of electrical

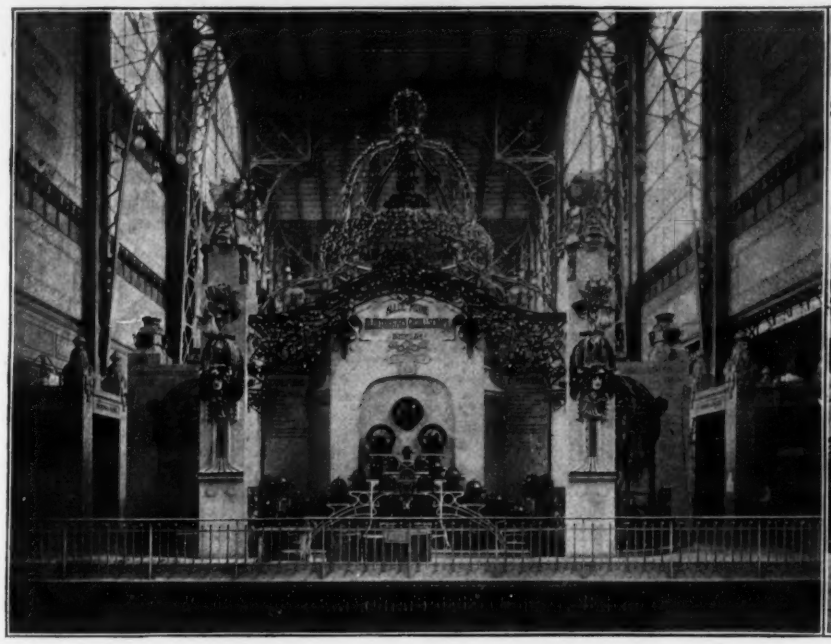


FIG. 1.—ALLGEMEINE ELEKTRIZITATS GESELLSCHAFT PAVILION, GERMAN COURT OF HONOR.

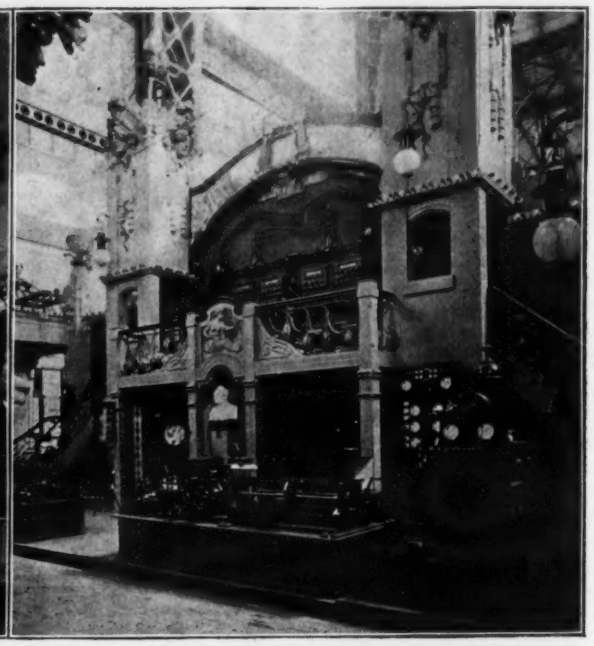


FIG. 2.—MAIN SECTION SIEMENS-HALSKE EXHIBIT, GERMAN COURT OF HONOR.

machinery, while the four smaller spaces are devoted to exhibits of apparatus for feeble currents. In one of these spaces is shown a telephone central station for 14,000 subscribers, completely furnished; in a second space are shown electrical instruments for transmitting orders and signals on board ship, in mines and industrial establishments; section 3 contains fire alarms for streets and interiors, time and watchman's clocks, etc., and the fourth section is devoted to laboratory and switchboard instruments of all kinds.

The Schuckerts show a number of their reflector mirrors, reflectors, an automatic battery controller and miscellaneous apparatus. Voigt & Haeffner exhibit switchboard instruments and a sample switchboard panel for a 10,000-volt circuit, identical with those installed by this firm in the Cherasci (Italy) transmission plant, and in the Albert Court and Wood Lane Electricity Works in London.

The University of Goettingen exhibits a working desk of the laboratory for electro-chemistry. On the desk is arranged, in working order, the apparatus for the demonstration of the migration of ions, and apparatus for the determination of dielectric coefficients. To the back of the desk are fastened a rheostat, an ammeter and an automatic circuit breaker. On the desk there are also the usual chemical instruments and apparatus; bottles with reagents, etc. Three photographs are attached to the back of the desk, viz., the Gauss & Weber statue at Goettingen, the Physico-Chemical Institut of the University of Goettingen and the Wöhler statue at the same place. In the

glass-doored case of the desk is seen in working position, apparatus for the electro-chemical separation of nickel and cobalt, and an apparatus for the determination of dielectric constants by the high-frequency method.

The Swiss Court of Honor is also of very pleasing design, being provided with a sort of monumental main entrance, consisting of four columns, united by a nicely-decorated arch; on the latter the name "Suisse" is inscribed in ornamental letters, and above the word is the Swiss emblem—the white cross on a red background. Two statues, representing soldiery of the middle ages, form part of the ornamentation of the arch. The court contains, as already stated, a collective exhibit of water-color drawings, maps, photographs and models, relating to electrical transmission plants in Switzerland, and exhibited by the following firms: Maschinenfabrik Oerlikon, Escher Wyss & Cie, Sulzer Freres, Brown, Boveri & Cie, Theodor Bell & Cie, Compagnie de l'Industrie Electrique, Alioth, J. J. Rieter & Cie, Société Suisse pour la Construction des Locomotives et des Machines, and Picard, Pictet & Cie.

Two models in wood of a generating unit in the water-power plant at Chevres (Geneva), are shown. It is stated that this station contains 15 units, each of from 800 to 1200 horse-power, thus making a total of 12,000 to 18,000 horse-power. Two other models show the works and their location. A large map of Switzerland shows all the lines of electric power transmission in operation in that country, with the exception of those entirely of a private nature. The large water-power transmission plants of Rheinfelden and Rathhausen, and the Jungfrau Railroad are very thoroughly illustrated by drawings, photographs and maps. This exhibit shows strikingly the advanced state of development which the electrical manufacturing industry and the transmission of power by electricity have attained in Switzerland.

There are also a number of stands in this section, at which electrical instruments of Swiss manufacture are shown. The Société Genevoise de Construction d'Instruments de Physique shows a number of watt-hour meters, and A. Aubert, Lausanne, exhibits his ampere-hour meters. H. Cuneod, of Geneva, shows a number of specialties of Thury's design and invention. The main stand contains a collection of Thury arc lamps, small motors and automatic regulators, while in an adjoining stand is shown a Thury electric clock for time distribution and for the control of astronomical instruments. This clock is placed on a pedestal. On the opposite side of the gallery is a stand at which a Pathé loud-speaking phonograph is shown in operation. This little instrument let its penetrating voice resound through the empty halls of the gallery the day the Exposition was opened to the public, and it has enjoyed a good attendance at its seances ever since. Peyer, Favarger & Cie have on show an exhibit of electric clocks and electric railroad signaling apparatus.

The French Cour d'Honneur is a pavilion of square floor space, with low and almost unembellished dark-painted wall, thus bringing it into marked contrast with the general lines of construction followed in the French sections and in the architecture of the Exposition in general. The two side walls of the pavilion are made up of booths containing exhibits of private firms. The salon is covered by a skylight of translucent cloth, and this method of illumination, together with the low walls, gives one the impression of a sanctuary—a mausoleum.

The two end walls have each a gate, but only one of these is usually open. Above each of these entrances the following inscription is found: Exposition Centennale Électricité, 1562-1900. The right-hand panel of the south wall contains framed drawings of the electric locomotive of the Paris Lyon, Mediterranée Railroad, and the left-hand panel contains drawings relating to the 47-mile, 20,000-volt transmission line between the Falls of Saumon and Limoges. There is shown a map of the line, a cross-sectional view of the station, a general view of the station and falls, and a drawing of the poles with the insulators and wires in place. The panels of the north wall are taken up by the exhibits of the Western Railway of France. The left panel has drawings of an electric locomotive, a map of the electric circuits of the road in and around Paris, a profile of the line Invalides-Versailles, and drawings of a compressed-air locomotive, of the transformer station at the Champ de Mars, the Moulineaux Westinghouse power station, already described in these pages, and of the compressed-air sub-station at the Invalides. The right-hand panel contains a cross-sectional drawing of the rail bed of the electric road of this company, and a number of cable junction boxes employed in the construction of this line.

Entering now into the salon, we find glass cases with shelves all around the walls. On the shelves are placed historical instruments, books, manuscripts, etc., relating to the science and to the application of electricity. Around the walls, above these cases, are inscribed the names, and years of birth and death, of illustrious French physicists and electricians, from Coulomb, 1736-1806, to Fizeau, 1819-1896. In the centre of the salon are placed a number of larger instruments and machines, and around these some historical dynamos. The Gramme Company exhibits an electric plating dynamo built in 1872, an elliptical Gramme machine, with cast-iron field frame in one piece, built in 1878; the first dynamo of this firm with a brush rocker or adjustable brushes (1876), and a dynamo, resembling the Sperry arc-light machine, with the poles inside and outside the armature. There is also an "Alliance" magneto-generator of the type formerly used for lighthouse lighting, and the field part of a Lontin revolving-field dynamo. A small Lontin hand dynamo has a pole armature with two sets of poles and windings, one winding serving to generate the current for the field, and the other one to generate current for the line. The Collége de France exhibits an apparatus having served for the determination of the legal ohm. It consists of a number of coils pivoted on an axis, and which can be rapidly spun through an angle of 90 degs. Besides this, there are a number of frictional electric machines of an early period, and some permanent magnets.

Among the instruments and apparatus exhibited in the cases may be mentioned a model of a Pacinotti machine, constructed under the great Italian's direction in 1860; a mercury resistance standard and

FIG. 3.—ENTRANCE TO GALLERY IN FRONT OF FRENCH COURT OF HONOR.

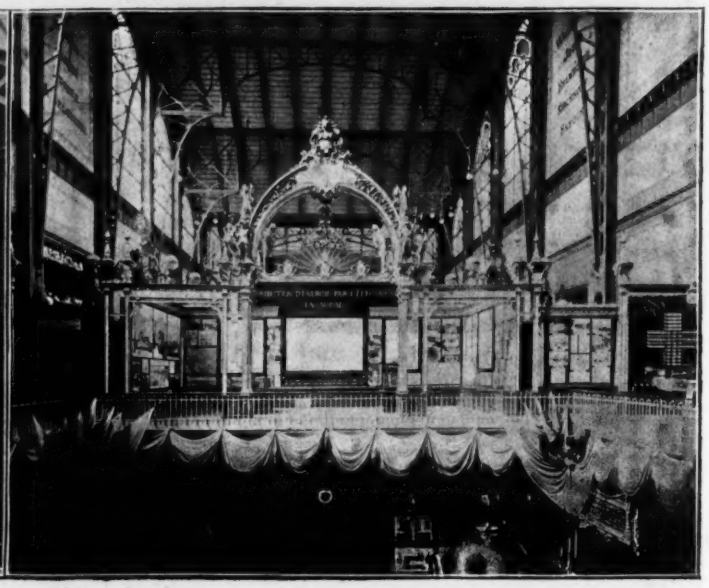


FIG. 4.—SWISS COURT OF HONOR.

a thermo-electric battery of Pouillet, a magneto machine of Pixii, constructed by the latter under the direction of Ampére; Coulomb's balance, Berthelot's electro-chemical apparatus and an assortment of Jablochkoff candles. In three corners of the room are placed poles to which are fastened telegraph insulators of the various types which have been used in France since the earliest days of telegraphy. The cases also contain a large number of old books relating to electricity and magnetism. The oldest which the writer noticed was in Latin, by Otto von Guericke, published in 1672. A copy of a French translation of Franklin's "Experiments and Observations on Electricity,"

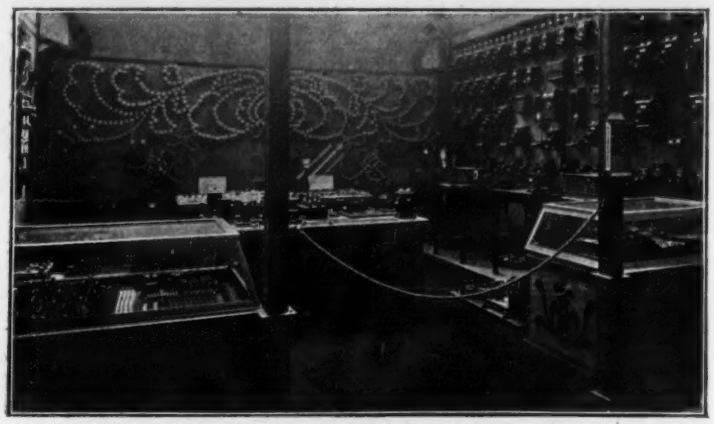


FIG. 5.—A SECTION OF THE HUNGARIAN COURT OF HONOR.

published in 1752, is shown, as well as a translation of his "Works" (1773). The title page of the latter contains a portrait of Franklin, to which are subjoined the appreciative words, referring to his experiments in atmospheric electricity and his deeds of patriotism, with which he was received in Paris. There is also shown a portrait and an autograph letter of Faraday.

The British Court of Honor is separated from those just described by one of the main longitudinal passages of the gallery, and it extends from the United States court to the Swiss court. All the space is devoted to the exhibition of modern apparatus. James White, of Glasgow, shows the various beautiful instruments of Lord Kelvin's invention, and of his manufacture. The well-known current balances of Lord Kelvin can be seen here in all the different sizes, and there are besides to be found rheostats, an electrometer, an astatic reflecting galvanometer, Wheatstone bridges, and engine-room indicating

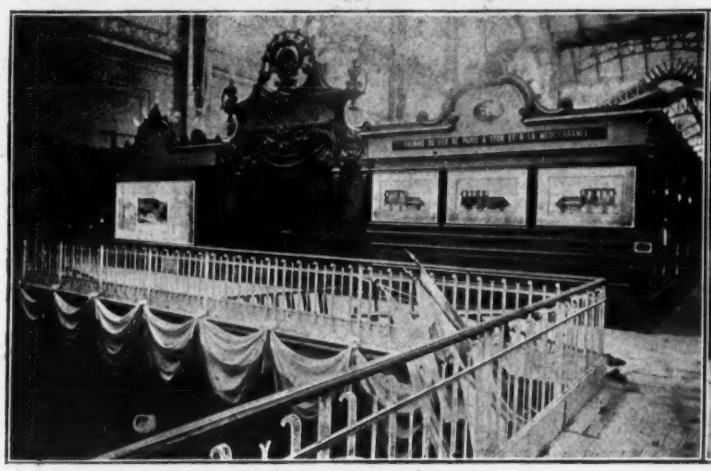


FIG. 6.—FRENCH COURT OF HONOR.

and registering instruments. W. A. S. Benson & Co. show electric light fittings, and Belshaw & Co. switchboards, switches and indicating instruments.

A very interesting exhibit is that of Gerard Cowper-Coles, containing specimens of work made according to the processes invented by Mr. Coles. A number of copper tubes, formed by electrolytic deposition, are shown to illustrate the effect of rotation on the structure of the layer of deposited metal. The velocity of rotation, of the different tubes shown, was graded from nothing to that employed in the Cowper-Coles centrifugal process. A number of parabolic reflectors made by the Cowper-Coles process are also shown, and specimens of the following metals, deposited electrolytically: gold, platinum, palladium, iridium, chromium, cadmium, brass, nickel, cobalt, iron and silver.

The Simplex Steel Conduit Company, Ltd., shows electrical conduits and junction boxes. A large space is devoted to the exhibition of British Post Office Telegraphs, showing all the different types of instruments in use by the British Post Office, including a wireless telegraphy outfit. The Electric Power Storage Company, Ltd., exhibits a large variety of stationary and portable storage batteries and instruments, used in connection with storage-battery work, such as hydrometers, automatic overload alarms, battery meters, etc. This firm also exhibits an electric vehicle, equipped with its cells, and possessing a number of novel features. It is a three-wheeler, seating two persons, and weighing 1500 lbs., of which 500 lbs. are made up by the battery. The steering wheel is placed in a front fork, which is connected to the frame of the vehicle by universal links. The prongs of the fork are braced by two rods, fastened to the front of the vehicle body. To the front fork is fastened a crossbar, and steering is effected by means of two leather straps, which pass through eyes on the ends of the crossbar.

There is also a very attractive exhibit of Crompton instruments, containing potentiometers, resistance standards, D'Arsonval galvanometers, Hibbert's one-volt standard, rheostats and switchboard instruments. The Automatic Magneto-Ignition Company exhibits a new form of spark generator for use with gas and gasoline engines. The movable part of the magneto is connected to the engine shaft by a rod, and has a rocking instead of a rotary motion. Several of these instruments are shown, equipped with crank and igniter terminals, so that by turning the crank by hand and watching the terminals, the spark can be witnessed. The Chloride Electrical Storage Syndicate, Ltd., shows a large exhibit of batteries, both stationary and portable; and Nobels Explosives Company, Ltd., besides other goods, exhibits electric exploders for high and low-tension blasting.

In the Hungarian Court of Honor there are a number of historical machines exhibited by Ganz & Co., of Budapest, viz., a multipolar, external armature, direct-current machine, two transformers and three other dynamos with fields of the type employed by Thury, of Geneva. Ganz & Co. have a large exhibit of their regular manufactures in this section. They show lead-covered cables, large street junction boxes, motors, switches, wattmeters, switchboards and a Hakl arc lamp, in which the two carbons make an angle of 90 degs. with each other. The direction of greatest luminous intensity in this lamp is directly downward. The Société Anonyme des Tramways de Budapest exhibits a part of a car used on an "underground trolley" line. The construction of the trolley shoe and of the trolley channel

FIG. 7.—ONE END OF BRITISH COURT OF HONOR.

is clearly shown. It also shows photographs and drawings pertaining to the underground line of Budapest.

The General Direction of Posts, Telegraphs and Telephones of Hungary exhibits a collection of all the printed blanks used in its service, a special map showing the network of telephone circuits in Hungary, and an album of photographs of stations and lines. The various instruments employed in the service are also shown. The unique telephonic journal of Budapest has a special exhibit, showing a map of its lines and the various apparatus used by it.

A model of a tramway car for a vertical track, an invention of Zipernowsky, is also to be seen in this section. There is a slot formed by two lines of rails similar to the slots of cable car lines. The sup-

porting wheels of the car run on these rails. A sort of vertical truck, fastened rigidly to the car, runs in a channel underground, and steadies the motion of the car. The United Electrical Company, of Budapest, has an exhibit of telephone apparatus, incandescent lamps, instruments, etc., of which our illustration shows a view. It will be noted from the above description that there is much of a novel character to be seen in the Hungarian Court of Honor, and that a visit to its stands is well worth the trouble for those interested in electrical matters.

The Austrian Court of Honor, which adjoins that of Hungary, is

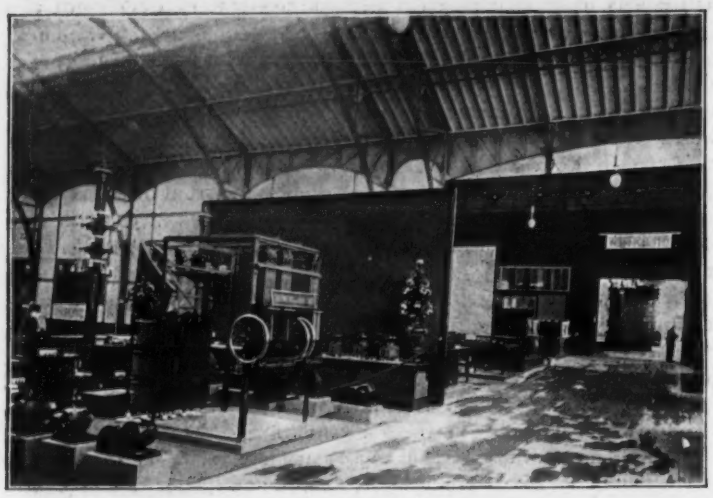


FIG. 8.—VIEW IN AUSTRIAN COURT OF HONOR.

notable for some very artistic exhibits. As an object of historical interest, an example of the first Pilsen lamps is shown, right beside a lamp of the latest type manufactured by Krizik, in Pilsen. This lamp is undoubtedly familiar to many readers of the ELECTRICAL WORLD AND ENGINEER from their college days and work. Siemens & Halske, of Vienna, show some artistic incandescent lamp fixtures, a large theatre dimmer, motors, rheostats and insulators on poles.

Félten & Guillaume, of Vienna, show copper and steel wires and cables in great variety, from the smallest sizes of lamp cord to a steel cable with a breaking strength of 2,400,000 lbs. Some cable junction boxes are also seen at this stand. The International Electric Company, of Vienna, shows transformers and general electric lighting supplies. The walls of the stand are furnished with drawings and photographs of its works. The United Electric Company, of Vienna, exhibits a model of a railway crossing barrier with automatic

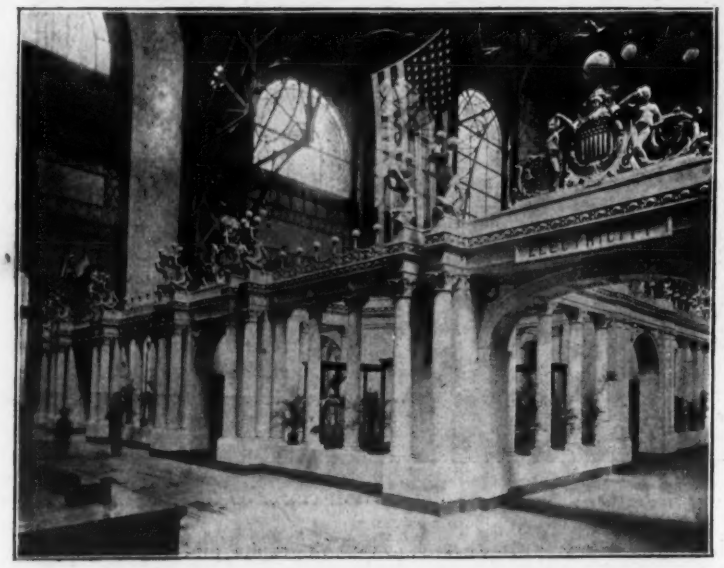


FIG. 9.—UNITED STATES COURT OF HONOR.

electric alarm bell. It has also on view a case with telephone and telegraph apparatus.

The Austrian Society of Steam Boiler Owners has an exhibit consisting of the regulations and reports of the society, swinging easels with photographs of steam boiler explosions, etc. The Tudor Accumulator Company, of Vienna, shows a large variety of stationary and portable batteries, positive and negative plates, and photographs of its works and some of its installations.

Some Electrically-Driven Machine Tool Exhibits at Vincennes, Paris Exposition.

Note has been made in these pages from time to time of the American Machinery Hall at Vincennes and of the exhibits there. The fact has been mentioned that the operative exhibits are driven by electric current, first by a temporary plant due to the loss of the Pauillac, and since then by the regular Ball and Bullock equipment.

The switchboard is located near the engine and on the side wall of the building. The mains run up from the switchboard in partitioned boxes on a side column and along the lower chords of the wing trusses to a point near the north crane track, where they are securely fastened to insulators disposed on an iron framing. From this point on the wiring is open. The wiring is laid out on the loop plan, the mains running up one side of the building, crossing on the end, returning by the other side and running back to the switchboard. The circuit is tapped at either end of the crane trolley, thus making the latter available for carrying load when the crane is not in use.

The main circuit passes over the space of each exhibitor, and by means of fusible cut-outs the branch circuits are connected. From this point on the wiring is at the expense of the individual exhibitor. The wires run along the building trusses to overhead motors, and along trusses and down columns to the motors placed on the floor.

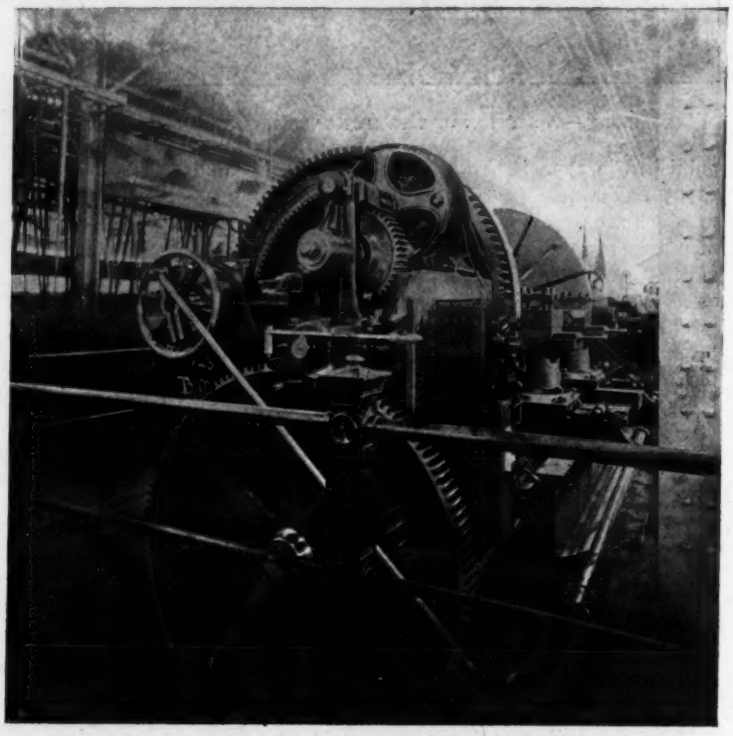


FIG. 1.—EXHIBIT OF THE NILES-BEMENT-POND COMPANY.

The circuits of two of the largest exhibitors, using each about 70 horse-power, are cross-connected, so as to secure economical service when only one of the exhibits is in operation. No meters are placed in the circuits, but the energy used is paid for according to the indication of a portable meter by means of which the power consumption of the individual exhibits has been determined. The machinery was put in place by an overhead electric tracking crane built by the Shaw Electric Crane Co. The crane has a capacity of 30 tons and is provided with an auxiliary hoist of five tons capacity. There is installed in the building a small telephone plant, connecting with another at the Champ de Mars. At the switchboards of these installations are stationed attendants speaking both French and English. Exhibitors having space at both Vincennes and the Champ de Mars much appreciate the advantage of a regular telephonic connection between the two places.

The E. W. Bliss Company has an exhibit of about thirty machines, consisting of punching presses, circular shears, etc. It derives its power from a 30-hp, C & C motor, placed on the floor and belted to a line shaft. Flather & Company have an 8-hp motor of French make, placed on a bracket on the wall of the building. The motor is belted to a line shaft and drives a planer and other machinery. The Acme Machinery Company uses one 10-hp, Elwell-Parker motor, driving a line shaft. It exhibits two bolt cutters, one nut

tapper and one forging machine. Each machine has its own countershaft. The Ingersoll Milling Machine Company, of Brockford, Ill., shows a large 36-in. milling machine, directly driven by a slow variable speed G. E. motor of 10-hp. The speed of the motor is variable between 390 and 500 r. p. m. The motor is placed on one side of the miller and the switchboard on the other. Brown & Sharp use one 70-hp, G. E. motor, placed on the top of a superstructure to which the line shaft and countershafts are fastened. This

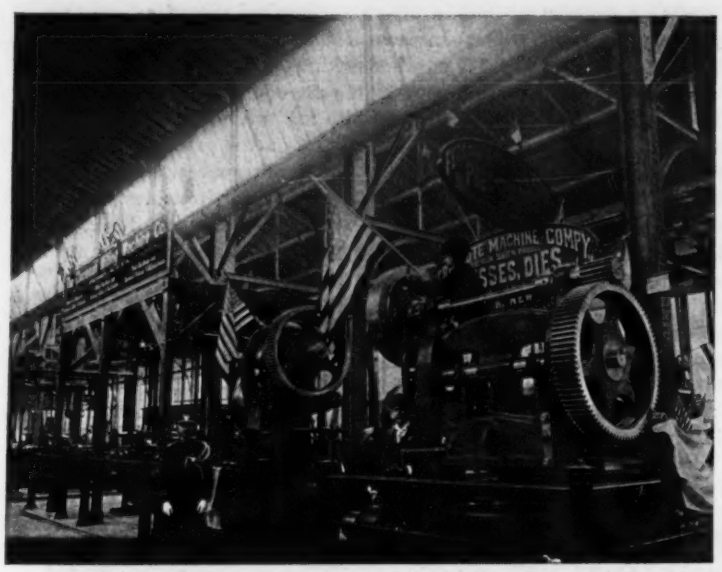


FIG. 2.—FERRACUTE CO. AND THE CINCINNATI MILLING MACHINE CO.

firm shows a line of its machine tools and small tools, besides a mechanism illustrating all the different motions, continuous and intermittent, which can be obtained by means of a gearing. Baker Bros., of Toledo, O., show, besides other machinery, a Colburn keyway cutter, which is geared directly to a 2½-hp, Bullock motor, making 450 r. p. m. The Bickford Drill Company uses a 12-hp motor of Jaquet Freres, standing on the floor and driving a line shaft. Fay & Egan, of Cincinnati, O., have, as noted in previous articles,

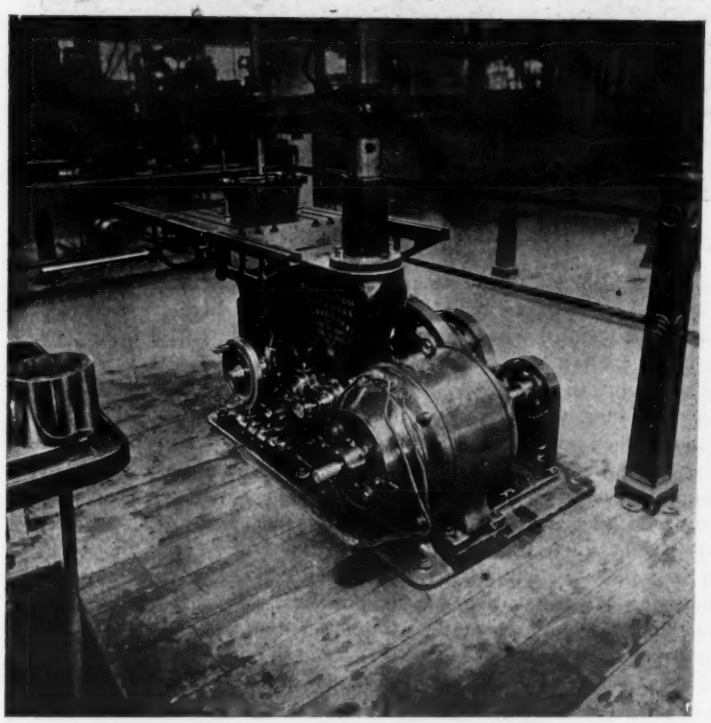


FIG. 3.—BAKER BROS.' KEY SEATER, DRIVEN BY 2½-HP BULLOCK MOTOR.

one of the largest exhibits in the building. They derive their power from four Triumph motors. One 60-hp motor is connected by a belt to a line shaft 40 ft. long, placed below the floor. This motor drives one moulder, one 5-spindle power bore, one triple-drum sander, one exhaust fan, one No. 4 large variety wood worker, one automatic knife grinder, one 5-cylinder flooring machine, one double-end tenoning machine, one No. 9 band saw and No. 19 30-in. cabinet surfacer; one box-board matching machine and one No. 5½ band-saw mill. An 11-hp motor drives a hollow chisel mortising machine, a 4-hp motor, an automatic glue-jointing machine, and a 3-hp motor on automatic gauge lathe.

Warner & Swasey, of Cleveland, O., drive their machinery by a 5-hp Westinghouse motor, placed on top of a superstructure and

FIG. 4.—THE NORTON AND STARRETT EXHIBITS.

belted to a line shaft. They exhibit a line of machine tools for working brass and iron. The Landis Tool Company, of Waynesboro, Pa., show a No. 3 grinding machine, driven by a 3-hp, G. E. motor, placed overhead. The Jones & Lamson Manufacturing Company, Springfield, Vt., exhibits a flat turret lathe and a Fellows gear shaper, which are driven by a 7½-hp, Sprague motor, placed on the floor and belted to a line shaft. Adolphe Janssens, of Paris, a large importer of American machinery, shows a variety of machine tools,

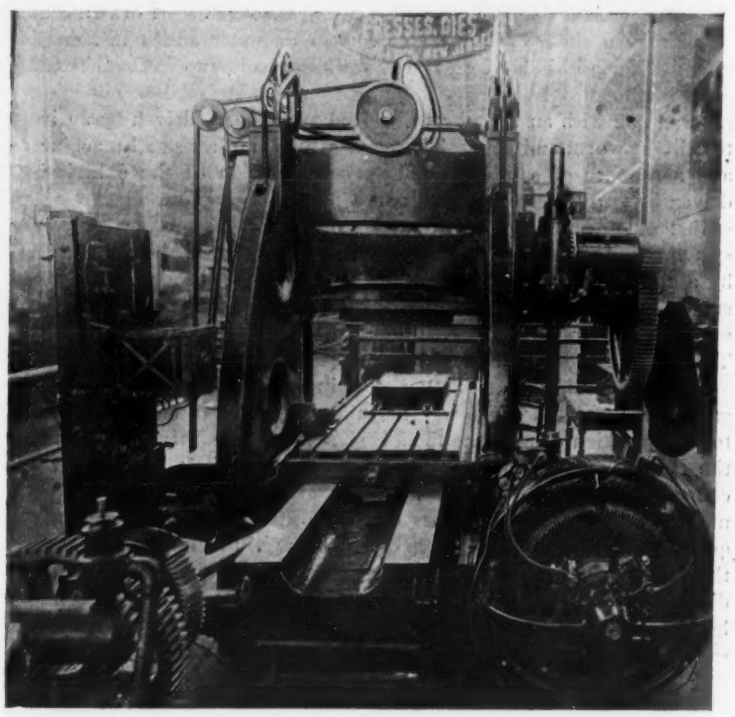


FIG. 5.—36-IN. INGERSOLL MILLING MACHINE AND G. E. MOTOR.

among which may be mentioned a 34-ft. lathe of the Springfield Tool Company. The exhibit is operated by a 15-hp Jaquet Freres motor, located on the floor and driving a line shaft. The Indo-Egyptian Compress Company has installed a 50-hp, G. E. motor, driving one of their Lowry presses and accessory machinery, by means of two intermediate shafts. Motor and shafting are placed below the floor.

While the exhibits of most of the firms represented consist of tools

of small and medium size, the Niles-Bement-Pond Company shows a variety of heavy metal-working machinery. It has a driving wheel lathe with quartering attachment, driven by a 7½-hp motor, directly geared. The quartering attachment is driven by a separate 2-hp motor, also directly geared. It also shows a Niles radial drill, driven directly by a 5-hp vertical shaft motor of the Milwaukee Electric Company's make. The motor is placed on top of the drill columns. The rest of the machinery of this firm is driven by a 20-hp, Westinghouse motor, belted to a line shaft. This machinery consists of a 10-ft. boring and turning mill and 18-in. shaper, an 8-ft. x 4 ft. boring, drilling and milling machine, a 16-in. slotter, a 6-ft. boring mill, a 42-in. planer and a 42-in. lathe.

The exhibit of the Pratt & Whitney Company, consisting of general machine tools, about twenty in number, is operated by a 16-hp C & C motor, placed on top of a superstructure, to which a line shaft and countershaft are attached. In this exhibit and the adjacent one, that of the Brown & Sharp Company, a large number of machines are cramped into a comparatively small space, and as both employ the line shaft and countershaft method of transmission, there is quite a profusion of belts in this section of the building, while, in general, belts are, of course, less in evidence than in the average large machine shop in the United States.

The Jeffrey Manufacturing Company, of Columbus, O., shows an electric chain coal-mining machine, driven directly by a 20-hp motor, and also a No. 1½ electric coal drill. Gould & Eberhardt have on exhibition a gear-cutter which is belted directly to a 20-hp, Sprague motor, and a polishing machine driven by a 1-hp motor of the same make. The Norton Emery Wheel Company shows a line of its products and has in operation a cutter and reamer grinder and an ordinary grinder driven by a 2-hp motor. All the cutting tools used in the building are ground at this stand, as none of the exhibitors have provided themselves with grinding apparatus. Other firms represented by an operative exhibit are the Cincinnati Milling Machine Company, using an 8-hp motor; the Ferracute Machine Company and the H B. Smith Company, using an 8-hp motor. The Ferracute exhibit contains six of their large, heavy presses, and is on the main aisle, near one of the entrances. There they show a handsome double-crank cutting press weighing about 1600 lbs., run by a separate Northern Electric 5-hp motor, with a new form of friction clutch. This press is designed specially for cutting large armature disks, and is of a kind now familiar in many electrical factories. Another special piece is a double-action drawing press, capable of drawing at one stroke a shell, basin, etc., 16 ins. in diameter and 4 ins. deep, intended for all kinds of brass and steel shell and cups. On the rear aisle is shown a heavy punching press and two smaller punching presses, one with an ingenious dial-feed attachment, driven by an intermittent worm and gear. There are also two other small machines and a number of samples. This general portion of the exhibit is driven by two lines of shafting and a 5-hp Eddy motor.

Just outside the building there is an exhibit of a belt-conveying system of the Robins Conveying Belt Company, which is operated by a 10-hp motor. This motor, although not of the enclosed type, stands in the open air. Electricity is also furnished to the McCormick Harvester Company's Building, to the English section, in the Transportation Building, and to other pavilions in the vicinity.

There are, in all, some thirty motors in the building, with an aggregate power of 350 horse-power, and the application of electric motors to the operation of machine tools is shown in all its forms. While in the majority of cases the motor drives a line shaft to which the countershafts of the various machines are belted, there are also a number of back-geared motors directly belted to the machines, and quite a few examples of motors directly geared to the machines. Of the latter, which always present special interest on account of the disposition of the motor and regulating apparatus, a number are herewith illustrated. The disposition of the motors on the ceiling, surrounded by belts and shafting, or in corners and dark recesses on the floor, has rendered it impossible to secure views of many of them.

Infernal Machines.—A number of Paris dailies have announced that an infernal machine had been found in the basement of the Grand Palace of Art. The statement has been confirmed, and it is said that the police authorities are on the track of the would-be vandals and assassins, whose motives were of an anarchistic nature. There is also claimed to be some connection between this incident and the fire in the Chateau d'Eau, several weeks after the Exposition was opened, which retarded the inauguration of this most popular attraction of the Fair for nearly a month. The engineer who was charged to investigate the cause has just handed in his report, indicating incendiarism.

The Exhibit of the American Steel and Wire Company.

The American section in the mining department of the Exposition is an exhibit of which Americans may well feel proud. The magnificent façade of this section, in electro-plated iron construction, with granite columns, and the lower panels in marble, forcibly attracts the attention of passers-by, and the well-selected and well-arranged products of American mines, mills and refineries, shown behind this façade, are the subject of much favorable comment. The façade has two arched entrances, and is adorned with 45 large medals or plates, on which the seals of States of the Union are engraved.

The American Steel & Wire Company has one of the largest exhibits in this section, part of it being located on the ground floor and part in the gallery. In the centre of the lower space is erected an octagonal pavilion, with two entrances, on opposite sides, which serves as an office. The pavilion is covered by a glass pane dome, the eight surfaces of which are outlined by rows of incandescent lamps. Each of the eight surfaces of the dome has a large colored pane, bearing the initials of the company. The six sides of the pavilion, not occupied by entrances, have show windows on the outside, in which are displayed different lines of the company's manufactures. Above these show windows, all around the pavilion, are inscribed the names of all the cities at which the company has offices. Of the six walls inside, one bears the names of the officers of the company, and negatives of some of the medals awarded to the goods of the firm. The other

AMERICAN STEEL & WIRE CO.'S EXHIBIT.

five are furnished with specimens of the company's manufactures, as follows: Bicycle spokes, odd-shaped wires and dies, electric wires and cables, spooled wire, and 22 samples showing passes from 4-in. x 4-in. billets to a No. 8 rod.

The American Steel & Wire Company is the owner of iron, coal and zinc mines, and the raw products of its mines are shown, as well as the finished ones of its drawing and rolling mills, and of its blast-furnace plants. A nicely-designed pyramid shows a collection of the various coals and iron ores mined by the company, some of the latter being as rich in iron as 67 per cent. One of the show cases contains a large number of test bars of steel of various grades, from those very low in carbon to the highest carbon steels. These test pieces are intended for making bending, drifting and elongation tests and tests for tensile and breaking strength. In another case are shown fractures of charcoal iron and steel ingots.

The collection of wires and wire goods is especially large and comprehensive. Wires of steel, iron, brass, bronze, copper, aluminum and German silver are shown, ranging in size from the barely visible steel wire of .001 in. diameter, of which 374,000 ft. are required to make one pound, to the largest used in commercial practice. The exhibit contains two coils of steel wire of .010 in. and .011 in. diameter, which contain 32.6 and 38.7 miles in a single piece, respectively. There are also to be seen some reels of trolley wire containing one-half mile and one mile of wire, reels of magnet wire, square and round, spools of bare copper wire, lamp cord, steel music wire, steel wire rope, fence barb wire, railroad fencing, etc.

At one side of the space is placed a large circular plate head of

basic steel of 123 ins. diameter and ⅜ in. thickness, having a tensile strength of 62,260 lbs. to the square inch. This plate is held in an upright position by two brass tube columns of about 2½ in. diameter.

Among the other products of the firm, shown at the Exposition, may be mentioned horseshoes, flat springs and flat spring steel, knife blades, spikes, nails and tacks, brass escutcheon pins, staples, coiled springs and cold-rolled shafting. To give an idea of the size of the company's business, it may be mentioned that the production of nails is 10,000 kegs per day.

A prominent place is given to an exhibit of rail bonds, which contains bonds of different types, flexible and solid, and of all the different lengths and sizes for which there is a demand. Other objects of interest are a case showing profiles of various drawn shapes and a number of diamond dies for drawing wires.

In the gallery of the mining section the American Steel & Wire Company has a long line of show cases in which it displays its goods. Above the show cases there are 16 framed photographs, being views of the company's mines and works.

In a circular of the company it is stated that the annual production of raw materials of the company amounts to 7,792,720 metric tons, and the production of manufactured articles to 1,524,000 metric tons. The capital of the company is $90,000,000, and the total number of persons employed is 36,000.

Messrs. J. A. Roniloba and E. J. Pietzker, with a number of assistants represent the firm at the Fair, and they are constantly at the stand, accommodating visitors and those desiring information.

PARIS EXPOSITION NOTES.

THE NATIONAL HOLIDAY of the French Republic—the 14th of July—was this year celebrated on an extraordinary scale, on account of the Exposition. More than double the usual sum was voted by the city authorities for illumination. All the public buildings were illuminated with thousands of small gas flames, running along the edges of the roofs, or forming the initials of the republic and the insignia of the city. The trees along all the principal boulevards were hung with Chinese or Venetian lanterns, which presented a very pleasing appearance. Outside of the Exposition grounds electricity played only a small part in the illumination. In matters electrical, the grand city of Paris is still comparatively backward. There was also in the evening a Venetian carnival on the Seine. A number of river passenger steamers and towing boats, gaily illuminated, cruised up and down the river, particularly where the latter is bounded by the Street of Nations on one side, and by Old Paris on the other. The illumination along the two banks, however, considerably outshone that of the river boats, which may not be one of the distinguishing features of an ordinary Venetian carnival.

MR. CARL HERING, who, after the jury of Class 25, of which he was vice-president, had finished its work, made a short trip to the seacoast, has just re-arrived in Paris. Mr. Hering has fully recuperated, and has resumed his other duties.

Electric Power Development in Canada.

Two weeks ago work was begun at Silverdale, Can., on the Hamilton and Lake Erie power canal, when E. A. C. Pew, the promoter of the canal company, and formerly of the Toronto, Hamilton & Buffalo Railway, gave an account of the company's plans. He had first organized the Canadian Steel Company, with a capital of $18,000,000, located at Welland, and the steel company was authorized to guarantee the bonds of the power company. The steel company has undertaken to do so, and to contract for 15,000 electric horse-power, which is to be supplied at the annual rate of $20 per horse-power. The source of the water is Welland River. That stream flows into the Niagara, and the waters of the latter river are more or less driven up the channel of the Welland, owing to their great force and to the deflection at that point. A power canal is to tap the Welland River at this overcharged section of its channel. The canal will run 6½ miles to Jordan River, a stream which enters Lake Ontario 20 miles from the mouth of the Niagara River. Along the Jordan are two or three falls, the highest of them being at Jordan village, where there is an abrupt fall of 100 ft. The total fall that can be utilized for power is about 250 ft. Mr. Pew says the canal will be completed at nearly the same time as the Welland Steel Works, which will be about September, 1901, and power will be transmitted to Toronto and Hamilton at about half steam rates. The initial plant is to develop 25,000 horse-power, which can be increased to 50,000 or 60,000, as required. Plans of the canal show that it is to be 150 ft. wide at the top, 60 ft. at the bottom, 12 ft. deep, with a current of 3½ miles an hour. It is estimated that it will cost $1,000,000 to construct. Electrical estimates indicating the cost of the electrical machinery have been received, Mr. Pew says, from the Stanley Company, at Pittsfield, Mass.; the Royal Electric Company, of Montreal, and others.

At the same time, it is stated that the Ontario Power Company, of Niagara Falls, Canada, has its affairs in good shape and now has all the necessary legislative rights to go ahead and develop 300,000 horse-power. The first installation proposed is of 30,000 horse-power. This company's plan includes a power canal on the Niagara River, discharging also just above the Horse Shoe Fall.

Recent Electrical Development in Italy.

Note is made in recent English consular reports of a power enterprise in Northern Italy, of considerable magnitude. The Società Lombardia per Distribuzione di Energia Elettrica, a company formed in 1897 with a capital of $1,600,000, recently increased to $2,000,000, obtained a concession from the government on the River Ticino, at Vizzola, some miles below its issue from Lake Maggiore, and immediately set about constructing works for the development of not less than 20,000 horse-power (theoretical) for industrial purposes. Since the works were begun the sanction of the government has been obtained to a project for the construction of a dam across the river some distance higher up, which would enable the company to increase its volume of water, and allow it to be constantly maintained during all seasons of the year. The theoretical hydraulic power would then be 24,000 horse-power and the actual current obtained 12,000 horse-power. This dam has not yet been commenced, but the works have been constructed on the basis of the larger supply of water. For the present only seven turbines of 2000 and two of 220 horse-power each have been put up. There are seven generating dynamos, three-phase, alternating current, of a capacity of 1650 kilowatts at a tension of 11,000 volts, and two exciters, continuous current, of a capacity of 145 kilowatts at a tension of 110 volts.

Five of the larger, as well as the two smaller turbines, have been made in Milan by Riva Monneret & Co., the same firm which made the seven turbines of 2160 horse-power each now working at Paderno for the Edison Company. The other two came from Germany. The dynamos and all the other electrical plant have been supplied from Germany. It was originally intended to bring this current into Milan, a distance of 25 miles, but the whole of it has now been disposed of in and about the manufacturing towns of Gallarate, Busto, Arsizio, Legnano and Sarsuno, which lie between Vizzola and Milan, a district which already, for the cotton industry alone, uses steam to the extent of 10,000 horse-power.

The price varies according to the importance of the supply required, but the average at which the whole of this force has been contracted for, is $24 per kilowatt per annum for use during 12 hours a day. Firms working 24 hours a day only pay a very slight increase. The current is transmitted by overhead cables, separate cables being employed for public lighting purposes.

It is stated that from 1896 to 1899 inclusive, 242 limited companies were organized in Italy with a capital of $71,500,000, and that a large part of this was raised for electrical enterprises.

An evidence of the interest taken in Italy in electrical matters is shown by the fact that in its issue of June 26, *La Perseveranza*, a large daily paper of Milan, devoted two whole pages of a special supplement to a paper read by Mr. Guido Semenza, before the Milanese meeting of the Italian Engineering Association, on the utilization of electricity in the United States. Mr. Semenza, who is the chief engineer of the Milan Edison Company, made a trip through the United States last year, and evidently used his eyes and ears to advantage. He mentions a number of factories, installations, lighting stations, street railways and power transmissions with discriminating praise. It is rather striking to see 12 long columns of a daily journal thus occupied by an engineering survey of a foreign country, but it must have been stimulating to a great many readers, and its appearance is certainly creditable to the tastes of the reading public of the north Italian city.

Considerable interest attaches to the new commercial reciprocity treaty between Italy and the United States in so far as it affects electrical apparatus. It goes into force now and remains operative until the end of 1903. The duty on American dynamos and motors is placed at 16 lire, or $3.09 per quintal (100 kilogrammes) on machines weighing over 1000 kilogrammes (2204 lbs.), in place of the general tariff of 30 lire, or $5.79. On dynamos weighing 2204 lbs. or less the reciprocity rate is 25 lire, or $4.83, per quintal, in place of the general tariff of 30 lire, or $5.79. Detached parts of dynamos will pay

25 lire, or $4.83, under the treaty, instead of 30 lire, or $5.79, which is the general tariff.

Electrical Possibilities in the Far East—I.

JAPAN.

By Philip Jaisohn, M.D.

PERHAPS there is no part of the world where electrical engineering is so much needed as in the Far East, including Japan, China and Korea. These countries possess productive soil, salubrious climate, mineral and agricultural wealth and intelligent and homogeneous populations. In fact, all of these countries are blessed with natural resources and conditions favorable to the development of various industries and commerce. What they are lacking is the power with which to develop these natural advantages for practical use. Steam or electrical power is what is needed most, especially the latter, as it can be very economically and conveniently developed in these countries by water-power.

Japan has during the past few years assumed an important rank in the list of commercial nations of the world, and in doing so she has, to a marvelous degree, increased her commerce with foreign countries and extended her home industries. Under the provisions of the new treaty with foreign powers, the whole empire is now open to foreign commerce and industrial enterprises. Every foreigner within her border is accorded the same rights and privileges as her own citizens, and his life and property are just as safe there as in his own country. The only privilege which is denied foreigners is the right of holding real estate, but this apparent illiberality is redeemed by the "Law of Superficies," which means ownership of the surface of land. It corresponds to a building lease of 99 years or longer, but the right of tenure may be purchased by a single payment at the outset, and the term of the lease may be as long as a thousand years or more. In short, this law answers all the practical purposes of real ownership, as it supplies every facility which foreign enterprise can possibly need for the safeguarding of its interests.

Japanese statesmen, as well as business men, fully realize the necessity of extending the electrical enterprises in the empire, and they are making every effort to encourage such undertakings. In recent years they have accomplished considerable in the way of electric lighting. but as yet only a very few miles of electric railway have been built. They have about 4000 miles of steam railway connecting most of the important cities, but, with the exception of three or four cities, there is no street car line in Japan. There are 208 towns having a population over 10,000, and 39 cities with 30,000 or more inhabitants, all of which must be provided, sooner or later, with electric tramways, electric lights and telephones. Most of the large cities have electric lights and telephones, but there is yet plenty of room for the improvement and extension of both.

Japan abounds with waterfalls and large mountain streams, which can be utilized in connection with electric plants. Of course, she possesses an ample supply of coal, but in many cases the water-power can be more economically employed. In the city of Kioto the municipality has an electric plant, which is run by water-power produced from a fall of 120 ft. This power supplies Kioto with two-thirds of electric lights, works the electric trams, the pumping of the water works, and no less than 66 different industries in or near the town. The entire plant cost the city government $250,000, and all the machinery used is of American manufacture.

In this connection, I might cite another instance in which the municipality makes good use of the electrical plant. There is a great trade and passenger traffic from Kobe to Lake Biwa, which is about a mile from Kioto. Boats formerly came up to Kioto River from the sea and discharged their passengers or cargo at Kioto. The distance of one mile between Kioto and the lake was traversed by rail, and the cargo then again embarked on the lake boats for distribution. This interruption has been done away with, and now upon arrival at Kioto the boats are floated into a cradle and hauled up the mile (the incline of which is 120 ft.) by a steel wire hawser worked by an electric motor. By this means the same boats cover the whole distance of 50 miles from the sea to the further end of the lake. The machinery used in this connection is also of American manufacture.

It may be of some interest to know what has been done in Japan in various lines of electrical industry. The Japanese Government now owns over 15,000 miles of telegraph lines on land and 1300 miles of submarine cable. The messages sent in a year exceed 25,000,000, while the traffic with foreign countries reaches 200,000 despatches. The first telephone exchange was opened in 1890, but in 1899 there were over 1000 miles of wire with 10,000 subscribers, each paying on the average 35 yen per year. There are nearly 50 electric light companies in the empire. As previously stated, the construction of electric tramways has not kept pace with the development in other branches of electrical industries. The city of Tokio—the capital of the nation—with a population of nearly a million and a half, has only five miles of electric railway now in operation. Besides Tokio, Kioto and Nagoya are the only other cities which have this system of transportation. Although a number of companies have been formed within the last few years with the view of building electric roads in different cities, the lack of capital and the stringency of the money market have delayed the fulfilment of the schemes. Foreign capital is anxiously sought by these companies and, according to recent advices, they have succeeded in getting some foreign syndicates interested in the enterprises.

American motors are generally used on those roads already built, but the Shibaura Engineering Works has turned out, for the first time, electric motors for the Kawasaki tramway. The Kawasaki Company is highly satisfied with the Shibaura dynamos, for it found them, as far as its experience goes, just as good as those of foreign make employed by other companies. The new Hoshu Electric Railway Company has placed orders with these works to construct all the motors for the company's use. The Shibaura works can obtain all the material for the construction of dynamos at home, except wheels and springs, which they have to import.

The telephone apparatus is generally manufactured at home, but the springs are imported. The Japanese instruments are much cheaper than those of foreign manufacture; therefore, but a small portion of the telephone apparatus is being imported. However, whenever the government is in need of a large supply for immediate use, the foreign article is purchased.

The electroplating establishment opened in 1887 in Mita, Tokio, was the first one started, but now there are over 200 shops in that city. Nickel-plating is most in demand. No definite information can be obtained as to the value of the yearly output of electroplated goods, but the demand is reported to have doubled during the last three years. A number of cotton mills have changed their motor power from steam to electricity. Recently several copper mines of Beshi and Ashio districts and the silver mines of Inai put new electrical plants in their stamping mills.

The Osaka Electric Company is one of the largest concerns in Japan. It practically monopolizes the electrical business in that city, which has a population of nearly 800,000, and is the most important manufacturing city of the empire. I will briefly mention the condition of this company, as it will give one an idea as to the growth, extent and the capitalization of such concerns in Japan. It was organized in 1889 with a capital of 400,000 yen ($200,000), which was increased to 800,000 yen ($400,000) in 1894, and to 1,600,000 yen ($800,000) in 1896. The paid-up capital of the company now amounts to 1,040,000 yen ($520,000). The company's principal business is to furnish electric lights to the city, besides supplying electric power for different manufacturing establishments. The last-named enterprise was inaugurated in 1897. The following table shows the extent of the business carried on by this company during the last 10 years:

Year.	Incandescent No. of Lights.	Arc No. of Lights.	Electric Power, Horse-power.
1889....	1,681	11	..
1890....	2,934	11	..
1891....	5,513	26	..
1892....	7,246	53	..
1893....	9,840	83	..
1894....	13,152	82	..
1895....	16,623	59	..
1896....	21,282	71	..
1897....	25,938	137	85
1898....	27,839	153	157
1899....	29,834	113	232
March 10 1900....	31,364	144	254

The number of factories which obtain their electrical power from this company is 85 (March 10, 1900). They are mostly rice-cleaning establishments, printing offices and iron works. The company had some difficulties in the beginning, but it now enjoys a considerable degree of prosperity, its financial status having become so favorable that it is now able to distribute its profits at the rate of 16 per cent per annum.

The first electric light company that was organized in Japan was the Tokyo Electric Company, which was followed by similar companies in Kobe, Osaka, Kyoto and Yokohama. As to their charges, they differ quite considerably. For instance, the Tokyo Company charges 3 yen ($1.50) per month for a light of 16 candle-power, to be used throughout the whole night; the Yokohama, 2.50 yen ($1.25); the Kobe, 1.95 yen (97½ cents); the Osaka, 1.70 yen (85 cents); the Kyoto (which utilizes water-power), 1.20 yen (60 cents). The percentage of the last dividend these companies declared was as follows:

The Kyoto Company, 17 per cent; the Osaka Company, 16 per cent; the Kobe Company, 14 per cent; the Tokyo Company, 8 per cent; the Yokohama Company, 11 per cent.

According to recent advices an electrical power and railway company has been organized in the city of Shizuoka, in the prefecture of Shizuoka, with a capital of one million yen ($500,000). The company is erecting electric plants in the neighboring towns, Tomizawa and Tadamma, and each will be capable of developing 400 horse-power, for which purpose the tributaries of the River Abe will be utilized. The company intends to run electrical tramways between Shizuoka and the surrounding towns, but the main line will run to the port of Shimizu, a distance of about nine miles from Shizuoka.

The following statistics show some of the principal electrical supplies which were imported into Japan during the last four years for the use of the various electrical enterprises:

	1896.	1897.	1898.	1899.
Electric dynamos	$7,042	$83,814	$45,707	$6,285
Electric light machinery	329,856	295,890	332,859	271,288
Telephone apparatus	2,578	175,026	80,040	130,875
Telegraphic apparatus	15,402	4,809	31,278	16,208
Telegraphic wire	92,429	37,669	32,145	408,600
Electric light wire	2,455	53,806	38,986	48,269
Electric lamps	3,231	7,055	2,916	33,893
Submarine cable and underground telephone wire	559,839	160,458	75,584	96,950

It is only a question of a few years before all the cities and towns of that Island Empire will be connected by trolley lines, lighted by arc and incandescent lamps, and communicated with through telephones. Hithertofore any enterprise of this kind had to be developed entirely with native capital, as under the old treaty no foreigner was allowed to reside outside of four or five open ports without special permission, nor was he permitted to hold stocks in Japanese manufacturing or commercial companies. However, since last July, when the new treaty between Japan and foreign nations took effect, the whole country is open to the citizens of every nation which has treaty relations with her, and they now have the right to form companies and build factories in any part of the empire. The comparatively high rates of dividends which the Japanese investments pay will undoubtedly attract many foreign capitalists when the conditions of the country and the sentiment of the people toward foreigners are more thoroughly known to them. I cannot, in this article, dwell much upon the latter point, but I will quote what Viscount Aoki, the present Japanese Minister of State for Foreign Affairs, said at a banquet given by the International Committee at Yokohama, which represents the predominant sentiment of the Japanese people. He said:

"As far as my countrymen are concerned, I can assure you that all classes of Japanese, even in the remote parts of the empire, will welcome you with open hearts, and join hands with you in all the various activities of life, and I sincerely trust that the foreign residents will not regard themselves as strangers in a strange land."

A few words concerning Japanese finance may not be out of place here. For centuries Japan has used both gold and silver as her currency, but since the opening of the country to foreign trade, it gradually drifted to a silver basis. However, in 1897, the government rather heroically discarded the white metal and adopted the gold standard, as it was thought it would benefit the Japanese merchants in their foreign trade. There was much opposition against the new movement, both in and out of the government, but it was finally carried and the gold monometalism became the law of the land. The national treasury has redeemed during the last two years about 60 million silver yen, but at no time was the treasury gold reserve reduced to an alarming degree. The budget for the current fiscal year, as it passed the Japanese Parliament, shows that the appropriations amount to 246,953,094 yen, while the revenue is estimated at 246,451,706, leaving a surplus of 501,288 yen. This is highly satisfactory for Japan, as she experienced some difficulty in meeting her expenditures with her revenue during the two previous years. This improvement was brought about by the increase of the tax on tobacco and sake (Japanese rice wine).

I have said enough to show the great possibilities which exist in Japan for electrical trade, electrical engineering and electrical investments, and in another article I will briefly write of her neighbor across the Yellow Sea, who is gigantic in size, but infantile in her electrical and other industrial developments.

Elements of Illumination—VII.

By Dr. Louis Bell.

DOMESTIC ILLUMINATION.

THE lighting of houses is a most interesting and generally neglected branch of illumination. Artificial light has been distinctly a luxury until within comparatively recent times, and in domestic lighting there has not been the same pressure of commercial necessity which has resulted in the general efforts to illuminate other buildings. Indeed, until within half a century there was very little effort at really good illumination in the home, every one depending on portable lights, which could be brought directly to bear upon the work in hand, gas, which provides fixed radiant points, being confined to large cities, and in these to houses of the better class. Even at the present time very little pains is taken to arrange the lighting in a systematic and efficient manner.

The comparatively small areas to be lighted in dwellings, the small need for extremely intense light and the very discontinuous character of the need for any light at all, render domestic lighting rather a problem by itself. Of ordinary illuminants all may be freely used for such work, save arc lamps and very powerful gas lamps, such as the large regenerative burners and the most powerful incandescent mantles. Arcs are of very unnecessary power, hence most uneconomical, and are generally so unsteady as to be most trying to the eyes. In the home, as a general thing, one does not keep the eyes fixed in any definite direction, as one would if working steadily by artificial light, so that far more than usual care must be taken to avoid intense and glaring lights. Therefore, arcs are most objectionable, and the gas lights of high candle-power equally so, particularly as the latter throw out a prodigious amount of heat and burn out the oxygen of the air very rapidly. As to other illuminants, the main point is to choose those of low intrinsic brilliancy, or to keep down the intrinsic brilliancy by adroit and thorough shading. Anything over two or three candle-power per square inch it is well to avoid as needlessly trying to the eyes without any compensating advantage save economy, which can better be secured in other ways.

Aside from the physiological side of the matter, very bright lights seldom give good artistic results, or show an interior at anything like its true value. Of the common illuminants, gas and incandescent lamps are those generally most useful, with petroleum lamps and candles, as, even now, auxiliaries by no means to be despised. Prof. Elihu Thomson once very shrewdly remarked to the writer that if electric lights had been in use for centuries and the candle had been just invented, it would be hailed as one of the greatest blessings of the nineteenth century, on the ground that it is absolutely self-contained, always ready for use and perfectly mobile.

Now, gas and incandescents, while possessing many virtues, lack that of mobility. They are practically fixed where the builder or contractor found it most convenient to install them, for while tubes or wires can be led from the fixtures to any points desired, these straggling adjuncts are sometimes out of order, often in the way, and always unsightly. Besides, the outlets are often for structural reasons in inconvenient locations, and their positions need to be chosen very carefully if artistic effects are at all to be considered; so that while these lights are the ordinary basis of illumination everywhere that they are available, lamps and candles, which can be put where they are wanted and not necessarily where some irresponsible workman chose to put them, are often most useful additions to our resources.

In domestic, as in other varieties of interior illumination, two courses are open to the designer of the illumination. In the first place, he can plan to have the whole space to be lighted carried uniformly or with some approximation to uniformity, above a certain brilliancy more or less approximating the effect of a room receiving daylight through its windows. Or, throwing aside any purpose to simulate daylight in intensity or distribution, he can put artificial light simply where it is needed, merely furnishing such a groundwork

of general illumination as will serve the ends of art and convenience. While the first method is for purely utilitarian purposes sometimes necessary, it is always uneconomical and generally most inartistic in its results. Its sin against economy is furnishing a great deal of light which is not really needed, while in so doing it usually sends light in directions where it deadens shadows, blurs contrasts and illuminates objects on all sides but the right one. The second method is the one uniformly to be chosen for domestic lighting, from every point of view.

In electric lighting the most strenuous efforts are being constantly made to improve the efficiency of the incandescent lamps by a few per cent, and an assured gain of even 5 per cent would be heralded by such a fanfare of advertising as has not been heard since the early days of the art. Yet in lighting generally, and domestic lighting in particular, a little skill and tact in using the lights we now have can effect economy far greater than all the material improvements of the last twenty years. The fundamental rule of putting a light where it is useful and concentrating it only where it is needed, is one too often forgotten or unknown. If borne in mind, it not only reduces the cost of illumination, but improves its effect.

In applying this rule in practice, one of the first things which forces itself upon the attention is the fact that the conditions can seldom be met by the consistent use of lights of one uniform intensity, or one uniform characteristic, as regards the distribution of the light around the radiant. Even one kind of illuminant is sometimes an embarrassing condition. Both the kind and quantity of the illumination must be adjusted to the actual requirements if real efficiency is to be secured.

As has already been shown, the effective illumination depends upon two factors—the actual power of the radiant in candles or other units, and the nature of the surroundings which determine the character and amount of the diffuse reflection which reinforces the direct light. If the radiant in a closed space furnishes a certain quantity of light, L, then the strength of the illumination produced at any point within the space will depend, if the walls are non-reflecting, simply on the amount of light received from the radiant, in accordance with the law of inverse squares. If the walls reflect, then the total illumination at any point will be that received directly, L, and in addition a certain amount kL (where k is the coefficient of reflection), once reflected, a further amount $k^2 L$ twice reflected, and so forth. The total illuminative effect will then be:

$$L(1 + k + k^2 + k^3 + \ldots k^n)$$

As k is obviously always less than unity, this series is convergent upon the limiting value, $L\left(\frac{1}{1-k}\right)$ which expresses the relative effect of the walls in reinforcing the light directly received from the radiant. It is clear from the values of k already given for various surfaces, that such assistance may be of very great practical importance. A simple experiment showing the value of the light diffusely reflected is to read at some little distance from the radiant in a room having light walls, and then to screen off the direct rays by a screen close to the radiant and just large enough to shade the book. If the conditions are favorable, the amount of diffused illumination will be somewhat startling. A repetition of the experiment in a room with dark walls will exhibit the reverse condition in a most striking manner. A good idea of the practical amount of help received from diffusion may be gained by computing the effect for various values of k. The following table shows the results for values of k between .05 and .95.

k	$L\left(\frac{1}{1-k}\right)$
.95	20.
.90	10.
.85	6.66
.80	5.00
.75	4.00
.70	3.33
.65	2.85
.60	2.50
.55	2.22
.50	2.00
.45	1.81
.40	1.66
.35	1.53
.30	1.42
.25	1.33
.20	1.25
.15	1.17
.10	1.11
.05	1.05

These values show the great difference between good and poor diffusing surfaces in their practical effect. Reference to the table already given shows that ordinary wall surfaces give values of k ranging from about .60 down to .10, or less. These are likely to be reduced by the gradual absorption of dust at the surface, but it is quite within bounds to say that the effective illumination in a room may be nearly or quite doubled by the light diffused from the walls.

In practice the interior finish of dwelling houses is highly heterogeneous, the walls being tinted, broken with doors and hangings, the ceiling being often of another color, and the floors covered with colored rugs or carpets, and generally provided with furniture at least as dark as the walls. The floor is in point of effect the least important surface from the standpoint of illumination, for it not only carries the furniture, but from its position cannot diffuse light in any useful direction. So far as it is concerned, only the terms in k^2 and higher powers enter the general equation, since illumination from below is not of any practical account whatever.

On the contrary, the ceiling is a very important consideration, for the light diffused downward is highly valuable. Paneled or vaulted ceilings are notorious in their bad effect upon the illumination. If used at all, they should be employed with full knowledge of the fact that they quite effectively nullify all attempts at brilliant, general illumination, and when considerations of harmony permit, ceilings ought to be very lightly tinted. As to the walls themselves, wainscoting and dark, soft-finished papers absorb light very strongly and render lighting difficult, while the white-painted wood and light papers freely used in colonial houses produce exactly the reverse effect. The character of interior finish being determined by the contemporaneous fashion can, of course, seldom be really subordinated to the matter of illumination, which affects only personal comfort; but in planning a scheme of decoration it is necessary to bear in mind that the darker the general effect the more light should be provided for. The outlets for gas and electricity provided for and quite adequate to light a brightly-finished house, will prove entirely inefficient if a scheme of decoration in dark colors be afterward carried out, so that it is the part of wisdom to arrange the original outlets to meet the worst conditions for lighting. This will generally mean providing for about double the minimum amount of illumination wanted on the hypothesis of brilliant finishings.

If conditions demand or fashion dictates any attempt at very bright illumination, a sort of simulated daylight, these matters relating to diffusion are of very serious import. Fortunately, such is not the usual case. Where the main purpose is that already strongly urged of merely furnishing such illumination as is needed for practical or artistic purposes, there need be no effort at uniform intensity of light or at making dark corners brilliant; and while the aid of favorable diffusion is still important in reducing the total amount of light furnished, it no longer so completely controls the situation.

With the data now at hand we can form a fairly definite idea of the amount of light which must generally be provided. One can get at the general facts by considering the amount of light that must be furnished in a room of given size to bring the general illumination up to a certain value. The particular value assumed must depend upon the purpose for which the room is to be lighted. For instance, since 1 candle-foot is an amount which enables one to read comfortably, let us assume that we are to furnish in a room 20 ft. square and, say, 10 ft. high, a minimum of 1 candle-foot. To start with, we must make some assumption as to the amount gained by diffusion from ceiling and walls. This, in a concrete case, we can make an educated guess at from the data already given. In general, Wybauw found that in moderate-sized rooms the diffusion increased the effective value of the radiant 50 per cent, which, as it agrees pretty closely with our own values taking into account a light ceiling, we will use for the present purpose. Let the assumed radiant be at r, Fig. 1, and at a height of 6′ 6″ above the floor. Now draw an imaginary plane $a\,b$ at a height of 2′ 6″ above the floor, and take this as the surface to be illuminated. If r is in the centre of the room, the greatest distance from r to a corner of the plane $a\,b$ will be $\sqrt{216}$ ft. = 14.7 ft. Each candle-power at r must be reduced proportionately, so that 1 candle at r would give 1/216 candle-foot at the point in question. According to our hypothesis, diffusion aids by 50 per cent, so that instead of requiring 216 candle-power to give 1 candle-foot in the remotest corner,

the real amount would be 144 candle-power, which would be handily furnished by a cluster of nine 16-cp incandescent lamps. The result would be a room most brilliantly lighted, for, except very near the walls, the illumination would be much in excess of 1 candle-foot, rising to 4 or 5 candle-feet upon the plane of lighting, under and near the lights. Such an arrangement of the lights is, however, uneconomical in the extreme, since the distant corners are illuminated at a very great disadvantage. Fig. 2 shows the advantage gained by a rearrangement. Here the room is divided by imaginary lines into four 10-ft. squares, and in the centre of each of these is a light 6′ 6″ above the floor, as before. Now, if a corner of the plane of lighting as *E* receives 1 candle-foot, the requirements are fulfilled. But *E* is distant from *D* just about 8 ft., from *C* and *B* almost exactly 16 ft. and

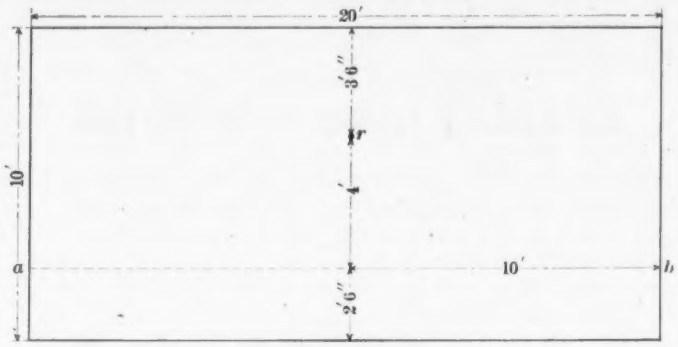


FIG. 1.

from *A* less than 22 ft. It, therefore, receives, neglecting *A*, for each candle-power at *D* 1/64 candle-foot, and for each at *C* and *B* a total of 1/128 candle-foot, or, allowing for diffusion, 1/43 and 1/87, respectively (nearly), so that it at once becomes evident that four 32-cp lamps are more than sufficient to do the work. Taking *A* into account, four 25-cp lamps would almost suffice, but obviously the maximum illumination is perceptibly lowered. It would be a maximum at the centre, and for 32-cp lamps would there amount to 2 candle-feet. A still further sub-division would lead to still better distribution from the point of view of economy, and, indeed, something can still be gained by a further redistribution of the light. For, with lights arranged as in Fig. 3, at the centre and on the circle inscribed in the room in question, five 20-cp lamps would very closely fulfil the conditions, reducing the total amount of light required to meet the assumed condition from 144 to 100 candle-power in all. Obviously, with a fixed minimum illumination and no other requirement, the conditions of economy will be most nearly met by a nearly uniform distribution of the minimum intensity required. There is, however, a limit to practical sub-division in limited areas, such as rooms. In the case of large buildings, as we shall presently see, one can easily figure out the illumination on the basis just taken, but in domestic

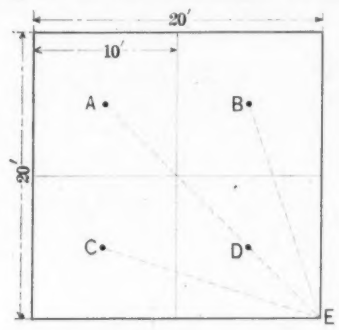


FIG. 2.

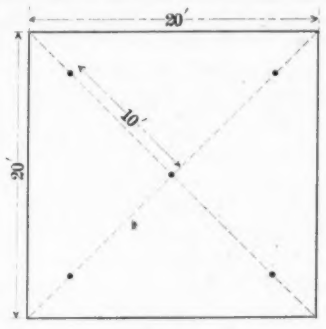


FIG. 3.

lighting we have to deal with a limited number of radiants, at least in considering gas and electricity.

By far the best results are attained by providing a very moderate general illumination and then superposing upon it strong local illumination for special purposes. For example, in most rooms better practical results than those of Fig. 3 would be reached by following the same arrangement, but using four 16-cp lamps and one 32-cp lamp, the latter being placed near the point where the strongest illumination is required. The result would be to give the extreme corners all the light they really need, and to provide plenty of light where it is of practical value. The same rules apply to the use of gas or other illuminants, always bearing in mind that the total amount of light required is strongly affected by the hue of the walls, and that the principal radiant should be placed where it will do the most good. Illumination thus regulated is both safer physiologically and far more efficient in use of the material than any attempt at uniform distribution over the entire area.

One's choice of illuminants must obviously be governed by the question of availability. Incandescent electric lamps easily hold the first place when economy is not the first consideration, by reason of their being quite steady, giving out little heat, and in no way vitiating the atmosphere. They should *always*, however, be furnished with ground bulbs, or so shaded as to reduce their otherwise very high intrinsic brilliancy. Next in order of desirability unquestionably comes gas. Used with the incandescent mantle burner, it is the cheapest known illuminant for domestic purposes, but in this form is too bright for anything except the principal radiant. Mantle burners should always be shaded, both to reduce the intrinsic brilliancy and to modify the greenish cast of the light which otherwise is highly objectionable. Ordinary gas jets, if the pressure be fairly steady, give a good subordinate illumination. Lamps and candles have strong merits for particular purposes, but are inferior for general work. The former are often used with good effect to furnish the principal radiant, which may be reinforced by small gas jets. Candles, on the other hand, are extremely useful for partial and subsidiary illumination, since they are the only available source of small intensity.

From this general basis of facts we can now take up the practical and concrete side of domestic lighting.

Automobilism in France.

During the week, from July 8 to July 14, the International Automobile Congress was held in Paris. The first session was held in the Palais des Congres, within the Exposition grounds, and the subsequent ones at the house of the French Automobile Club, 6 Place de la Concorde. The attendance at the first session was about 150. Of those present, however, very few were foreigners. M. G. Forrestier was made president of the congress, and Sir David Salomons, Ruys Orban and the Count de Dion, vice-presidents.

The work of the congress was divided into five sections, as follows: Section I.—Steam, gasoline and miscellaneous engines, Amedee Bollée, senior, president. Section II.—Electric motors, M. Monmerqué, president. Section III.—Transmissions, running gears, carriage work, Commander Mandin, president. Section IV.—Traction efforts, M. Forrestier, president. Section V.—Historical, economical and international questions, M. Ballif, president.

The Automobile Club of France, which organized this international congress, has recently had a secession from its ranks, and a new institution, the "Motor Club of France," has been formed. The latter counts among its adherents many of the automobile manufacturers, and has the support of a large portion of the technical press. The automobile congress did not receive sufficient publicity, and was, therefore, not the success it might have been.

While speaking of automobiles, it may be of interest to note that the Academie Française recently occupied itself in fixing the gender of the word automobile. So far, "automobile" has been considered a feminine noun, and the unanimity in this respect of all the writers on subjects of automobilism, and of manufacturers and users of these vehicles, made it seem impossible that the gender of the word could be changed at this late day. The question has been brought up on various occasions, and it was revived lately by an ordinance regulating the speed at which automobiles are allowed to run. In this ordinance, the masculine gender was employed in connection with the word automobile.

The French Academy, which is, of course, the best authority on the subject, has added the weight of its influence, and has decided that in the Gallic tongue at least, automobile is masculine. An electric launch may be a she, but an electric automobile is a he.

American visitors to France this year have been greatly impressed with the number and variety of automobiles shown in the Exposition and running around the streets, but they comment adversely in general upon the mechanism of many, and upon the disagreeable gasoline odor that so frequently accompanies their use.

To License Wiremen.

A bill will be presented to the Indiana Legislature requiring that electricians be licensed before they can become eligible to work at the business. This is to guard against improper wiring of buildings.

Death of Mr. Zueblin.

Mr. John E. Zueblin, General Superintendent of the Chicago Telephone Company, was run over and killed by a train on the Pennsylvania Railroad, near Bucyrus, O., on July 26. He and his wife were on their way home after spending some time at eastern summer resorts. According to despatches telegraphed from Bucyrus, Mr. Zueblin evidently arose from his berth and walked out of the car door while the train was in rapid motion. A later despatch states that a waiter on the dining-car of the train of which Mr. Zueblin was a passenger, testified before the coroner's jury that he saw Mr. Zueblin open the vestibule door and jump.

Mr. Zueblin was well known in telegraph and telephone circles. As a boy he served as a telegraph operator in Indiana. When the Rebellion came, as a lad of 15 years he volunteered at the call of President Lincoln and was detailed as the President's private telegraph operator, and he also saw service as field telegrapher under Gens. Grant and Sherman. Immediately after the war he re-entered the telegraph service and later became an official of the Western Union. He continued in its employ until 1880, when he secured a place as general superintendent of the American Union Telegraph Company. Four years later he became general superintendent of the Baltimore & Ohio Telegraph Company. His first entry into the telephone field occurred in 1889, when he was chosen general superintendent of the Central Union Telephone Company. His executive ability caused him to be selected general superintendent of the Chicago Telephone Company in 1892. Mr. Zueblin was born in Chester County, Pa., on Oct. 2, 1842.

Telephonic Controversy at Bryan, O.

A sharp dispute has arisen at Bryan, O., between the Bryan (independent) Telephone Company and the Central Union (Bell) Telephone Company, over the removal of the instruments of the latter corporation from the premises of those who have become subscribers to the opposition. What gives the affair unusual importance is the fact that President Thomas of the Independent Telephone Association of the U. S. A. has offered to assist the local independent company in defending the suit brought by the Central Company, and that Mr. W. W. Morrison, president of the dependent company, has accepted this assistance.

The suit is for $10,000 damages, the grounds alleged being malicious opposition, not only in Bryan, but in other cities of Ohio, Indiana and Illinois. It is alleged that "at sundry times during the month of June, 1900, and before and since, said defendant, the Bryan Telephone Company, through its said officers and agents, and through other of its employees, called upon a large number of plaintiff's subscribers, in the village of Bryan, and by persuasion, misrepresentation and threats and intimidation, induced a large number of said subscribers to sign a printed form of notice to plaintiff to discontinue its telephone service to said subscribers, and that on the second day of July, 1900, and before and since that date, said defendants, through their employees, did enter into the dwellings, offices and places of business of many of said subscribers, and did forcibly, wrongfully and unlawfully interfere with the property of plaintiff, to wit, its telephones, wire, and other fixtures connecting said telephones with plaintiff's exchange in said village, and said defendants, through their employees, did disconnect said telephones, break and cut said wires, and remove the same from their proper position and fastenings, thereby injuring and destroying said property belonging to plaintiff, and cutting off plaintiff's communication with its said subscribers, so that plaintiff was, and still is, unable to furnish telephone service between said subscribers and all other subscribers connected with plaintiff's said exchanges, both within said village of Bryan, and plaintiff's numerous other exchanges located and operated in the various cities, towns and villages of said states of Ohio, Indiana and Illinois, and also with other parts of its connecting lines extending over and through the territory hereinbefore described." The threats and intimidations referred to consisted in defendants threatening many subscribers that unless they should discontinue the service of plaintiff and use that only of defendant, the Bryan Telephone Company would use its influence to injure and ruin the business of such subscribers; and that these subscribers, fearing and believing that defendants would do as they had threatened to do, did discontinue the service to plaintiff's great damage. It is further asserted that defendants have induced many of plaintiff's subscribers to form combinations and agreements against the use of plaintiff's service, to the great annoyance and interference with plaintiff's business, and to plaintiff's great damage, and that the defendants have also wrongfully and unlawfully threatened to do injury to the private business of many of said subscribers, unless they should discontinue the service of this plaintiff and by these wrongful and unlawful threats, defendants have induced a great many of plaintiff's subscribers to discontinue the service, thereby greatly impairing the service furnished by plaintiff to its numerous other subscribers and with the general public.

This is the plaintiff's version. The defendants claim, on the contrary, that the officials of the Bryan Company were acting as the agents of persons desiring the removal of Central Union telephones from their premises, and at the request of such persons after the Central Union had refused to remove its own instruments when requested to do so.

CURRENT NEWS AND NOTES.

THE STOCK QUOTATION ROW IN CHICAGO.—According to a despatch from Chicago, of July 23, a new telegraph company is likely to step in as a result of the differences between the Board of Trade and the Western Union and Postal Telegraph Companies in that city, regarding the distribution of market quotations. The name of the new concern is the Cleveland Telegraph Company, and it is said that it has been distributing tickers in Chicago for the past two weeks in the expectation of supplanting the instruments of the two older companies.

A. A. A. S.—Members of the association will in future receive regularly the magazine *Science*. Although the annual dues are only $3.00, which is $2.00 less than those of the British and French associations, complaints have been made that there was no adequate return for membership. The inability of the majority to attend the annual meeting is largely responsible for this dissatisfaction, and the unanimous action of the council in deciding to send *Science* free of charge and to publish therein official notices and reports will be of great benefit to the association.

CHEAP POWER IN OTTAWA.—Probably the lowest rates for electric power have been established at Ottawa, Ont. The E. B. Eddy Company, shortly before the fire in Hull and Ottawa, contracted with the Deschenes Electric Company for several thousand electrical horse-power at $15 per horse-power per annum. Some of the Ottawa electric men, who control the Little Chaudiere water-power, offered recently to furnish a proposed cotton mill enterprise in Ottawa with 3,000 electrical horse-power at $10 per unit yearly. Electric power can apparently be delivered in Ottawa, with profit, at something like one-half the best figure that the Montreal Street Railway expects to obtain for the next quarter of a century.

MURRAY TYPEWRITING TELEGRAPH.—With regard to the Murray type page-printing telegraph, the patents of which were noted in our last issue as having been acquired by the Postal Telegraph Company, it is said to be now at work on some Postal lines. By this system, the message is produced on a narrow paper ribbon by means of perforations, which correspond to the Morse alphabet of dots and dashes; is then transmitted to the receiving station, automatically, is there reproduced on a second tape, and from that tape is printed in type by an automatic typewriter, at the rate of 114 words a minute, the highest speed yet attained by any automatic device. This speed has many times been attained by Mr. Murray on the Postal wires over a circuit of 388 miles, to Albany and back, while over the line to Chicago, a distance of nearly 1000 miles, a speed of 103 words has been obtained.

PROPOSED CHICAGO SUBWAYS.—President Roach, of the Chicago Union Traction Company, has submitted to the Street Railway Commission his plan for down-town subway terminals for all the traction companies. He estimated the cost of his plan at $24,000,000. The plan provides for 12 miles of subways. Six loops are provided for, and a tunnel under the river at Dearborn Street. Numerous stations are to be built along the route, affording every opportunity for passengers to reach the surface. The bottom of the subway is to be thirty feet below the surface of the street. All wire conduits and water mains are to be built in the subway, and not below it. Directly below the sidewalk are to be built four conduits, 6

ft. 6 ins. high and 5 ft. 6 ins. wide. These are to be used for telephone wires, Edison Company's conduits, city wires and pneumatic tubes, and telegraph wires. A 30-in. plate girder will separate these from the car subway. Two tunnels will be built where cars go in opposite directions. The widths vary from 16 ft. to 15 ft. 9 ins. A 3-ft. wall will divide the two parts. The platform for passengers will be 1 ft. higher than the running surface.

ELECTRIC RAILWAYS IN COREA.—A San Francisco despatch of recent date reports that Harry R. Bostwick, a civil engineer of that city, has just closed a contract with the government of Corea to build an imperial highway, 15 miles long, and an extension of the Corean electric railway on one side of it. The contract calls for the expenditure of $1,000,000, and this large sum spent by Corea is the reason, the imperial astrologers declare, why the spirit of the young queen, who was murdered several years ago, could not rest peacefully in the present cemetery. This cemetery is five miles from the king's palace, in Seoul, and to reach it speedily on the frequent pilgrimages required, the king conceived the idea of building the trolley line. Mr. Bostwick constructed it, and it was opened a year ago. Soon after the king decided it would pay to open the road for general use. So, to accustom the people to the foreign means of travel, all were allowed to ride free for one week. The experiment was disastrous, as a little girl, bidden by her father to cross the track in front of an approaching car, was killed. A mob tried to kill Mr. Bostwick and to wreck the road. When quiet was restored, motormen were imported from San Francisco, and the road once more ran as usual. Then the king, after holding out one whole year against the astrologers, decided to move the queen's body. But to do this he concluded to move the whole cemetery 15 miles inland to a place the astrologers declared propitious. Hence the contract with Mr. Bostwick and the big expenditure for the little kingdom. The tombs are very elaborate, and many of the sepulchres are of colossal size, so that the undertaking is large and costly.

SPIRAL STORAGE ELECTRODE.—A patent in this country has been granted to Donato Tommasi, of Paris, on a new storage battery plate. In ordinary construction, such plates, and particularly the positive plates, are subject to a series of expansions and contractions which occur in charging and discharging. These successive movements are liable to cause disintegration of the active material adhering to said plates, which after a certain period of use renders them unserviceable. With a view to remedy this defect, Mr. Tommasi has devised a special construction of accumulator-electrode in which these movements of contraction and expansion or augmentation of volume are rendered insensible to injuriously affect the construction. His electrode is formed, essentially, of a spirally-wound metallic strip, between the convolutions of which the active material is retained, this strip being composed of a resilient metal, antimony-lead or other suitable alloy of lead, or of a strip of steel, copper, bronze, etc., coated with lead. In order to render the coil unattackable by the electrolyte, it is coated with a composition consisting of a mixture of collodion and a sufficient quantity of platinum-black, peroxid of cobalt, binoxid of manganese, or other substance conductive of electricity to constitute a conductive mass unattackable by the liquid used as the electrolyte. The completed electrode can also be coated with the same composition for the purpose of increasing the cohesion of its constitutive elements. The accumulator-electrode of this invention is further characterized by the special composition of the active material, which consists of oxid of lead mixed with a certain proportion (about five per cent) of oxid of cobalt or binoxid of manganese. The addition of oxid of cobalt or of binoxid of manganese has the effect of rendering the charging more rapid, more intense, and more regular.

SYSTEM OF DISTRIBUTION.—Prof. Elihu Thomson has assigned to the General Electric Company, a patent just issued to him on a system of distribution, being a division of a former application, which, broadly speaking, related to circuits fed by a combination of constant-current and constant-potential transformers. The claims of the present application are more generic in character and cover a circuit fed conjointly from a constant-current transformer and a source of constant electromotive force which may or may not consist of a constant-potential-transformer secondary. In supplying a circuit from the secondary of a constant-current transformer and from a source of constant electromotive force, several important results are obtained. The regulating action of the constant-current transformer acts to maintain a constant current in the circuit, and this action takes place so long as the load on the circuit is such as to require an electromotive force greater than that represented by the source of constant electromotive force. Under these circumstances the load on the circuit can never be reduced to zero, but only to a minimum represented by the electromotive force of the constant-potential source. This condition of affairs is, however, no substantial disadvantage in practice. By employing this method of feeding a constant-current circuit a much higher power factor is obtained than would be the case if the total electromotive force were derived from the secondary of a constant-current transformer of a size large enough to generate the additional electromotive force, which, according to this invention, is supplied from a constant-potential source. A constant-current transformer of such increased capacity seriously reduces the power factor of the line when operating at light loads, while according to the present Thomson invention the constant-current transformer employed does not begin to reduce the power factor of the line to any appreciable extent until the electromotive force in circuit is greater than that of the constant-potential source.

MIRROR INCANDESCENT LAMPS are the subject of two patents just issued to S. D. Washburn and C. H. Tinkham jointly. Their invention is an incandescent lamp composed of the usual glass bulb, the usual glass tube for the leading-in wires, and a disk-shaped mirror extending across but separate from the bulb and supported by the glass tube sealed at its outer end to the neck of the bulb, through which tube and the disk-shaped mirror the leading-in wires extend and connect with the ends of the filament. The best way known to them for manufacturing such lamps is to make the mirror as a glass vessel with a broad base and a neck, the base when silvered constituting a concave mirror. In this glass vessel the terminals of the filament are sealed, and the neck of the vessel is then united with the mouth of the bulb by contracting it when at the proper heat about the neck of the vessel, also properly heated. In this way a bulb is obtained containing a sheet of glass across it, one surface of which can be silvered by pouring in the proper solution through the neck of the vessel. The bulb is exhausted and sealed in the usual manner and is then in all material respects an ordinary incandescent lamp, except for the sheet of glass across it, which preferably is not silvered until after the lamp is ready for the lighting current, but may, of course, be silvered at any time after the vessel is united with the bulb, for the heat necessary in sealing the bulb is not sufficient to injure the mirror. Of course one or both of the terminals of the filament must be insulated from the silvering film to prevent that film from acting as a shunt-conductor. The inventors say they have found it essential for the best results to make the mirror concave, and to use a sinuous filament in a plane which is approximately parallel with the concave surface of the mirror, for by this arrangement the rays from that portion of the filament nearest the mirror and which but for the mirror would be dispersed so as to be of little practical use, are reflected by the mirror and made to reinforce those rays which proceed from that portion of the filament furthest from the mirror, thereby greatly increasing the practical lighting of the lamp. Their second patent, however, states that they have also discovered that a helical filament has all the advantages of the zigzag, and that for certain uses, a mirror made of porcelain, glazed in its concave surface, is better than the metal and watch crystal mirror.

LETTER TO THE EDITORS.

The American Association for the Advancement of Science and the Press.

To the Editors of Electrical World and Engineer:

Sirs:—Your editorial of 14th inst. on publication of proceedings of the American Association for the Advancement of Science, suggests matters which have often engaged the attention of friends of the association. As early as 1849, the proceedings of the Cambridge meeting were stenographed by Henry M. Parkhurst, who still survives, and is a fellow of the association, residing in Brooklyn. His notes were published in one of the Boston papers. Probably that was the only meeting ever fully reported.

The sessions were then consecutive and single; but the formation of sections having simultaneous sessions has for many years past rendered it impossible for one person to cover everything. Recognizing this difficulty, local press committees have usually been formed.

At the Brooklyn meeting in 1894, we had such a committee, of which I was a member, and the only regular attendant at committee meetings. We succeeded in getting a tolerably full account of the meeting, but unfortunately marred by much buffoonery on the part of some local papers, which, to say the least, was not checked by the attitude of the press agent selected by my associates on that committee.

At the same meeting the council passed a resolution providing for the election of a press secretary in each section. From my personal knowledge of the workings of this system in that and the subsequent meetings, it may safely be said not to have accomplished the results intended. The press secretaries are not paid for services, and they do not have the papers or abstracts, which are held by the secretary of the section.

Having been elected as press secretary of Section I (Economics) during the majority of the meetings at which that section has had such a secretary, I have only once been called on for reports, and that was at the Springfield meeting in 1895, the best reported by the local press of any meeting since the sections were organized, though Boston, Brooklyn, Toronto, Philadelphia and Minneapolis did very creditably. The material I then supplied was far in excess of the requirements of the organ requesting it. Others of the press secretaries tell me they have never been called on for anything.

At the New York meeting just closed, the council adopted the new scheme of paying the secretary of each section $25 towards his expenses, conditioned on his staying at the hotel headquarters. This ought to stimulate the secretaries to do their share toward facilitating publication of reports; but as regards the Physics section, in which you are most interested, Secretary Fessenden has just written mé that he is too busy to send abstracts even of the three papers read by him, and which were promised as long ago as the time of the meeting; and this section has no press secretary.*

This explains one of the causes of difficulty in getting papers and abstracts; the authors themselves often have no written paper, but make their remarks orally, and do not prepare abstracts which convey any adequate idea of the theme discussed. Also the time when a paper is to be read can seldom be foretold, and a person in one section does not know what is going on simultaneously in the others. The last difficulty is remediable. At the Columbus meeting last year, all sections were connected by telephones, and an attendant noted on a blackboard in each section the papers as they were read in every other. This, for lack of funds, was not done here.

This brings us to the great obstacle to fullest success of the A. A. A. S.—the lack of adequate endowment. The annual dues are only $3 for each member. The full efficiency of the association requires a large endowment. Many Americans ought to become patrons by paying $1,000 each, instead of the four who alone have done this in all the lifetime of the association. With a replenished treasury, the work of the association should greatly expand. The administrative secretary, suggested in your article, could be employed; also means would be available for research on a scale commensurate with that of the British Association, instead of being limited, as at the recent meeting, to the appropriation of only $233 for the work of the year in this direction.

Wm. H. Hale.

Brooklyn, N. Y.

*Prof. Fessenden has, however, published in *Science* the following abstract of one of his papers: "In a paper on 'A New Theory of the Electromagnetic Rotation of Light,' the writer showed that whenever light is absorbed certain phase relations between the electric and magnetic forces and fluxes in the wave are shifted in such a way as to make the plane of the wave rotate when placed in a magnetic field, and evidence was given tending to show that this is a sufficient and probable explanation of the phenomenon."

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

Temporarily Conducted by E. F. ROEBER, Ph. D.

Dynamos, Motors and Transformers.

REFERENCES.

Calculation of Dynamos and Motors.—Niethammer.—An article giving several notes on different theoretical points; a note on the armature reaction of synchronous converters; a general investigation of the armature reaction of direct as well as alternating-current machines, based upon the consideration of two extreme cases of the relative position of the armature ampere windings and of the field ampere windings; a note on the voltage drop in three-phase alternators; a supplementary note to his article on the magnetic flux in slotted armatures (Digest, Nov. 25, 1899), dealing with the relation between the form and size of the slots, the air space and the heating of the pole pieces; a note on the sparking of machines with slotted armatures; a note on the influence of the form and size of the slots in three-phase machines, and a brief note on the predetermination of the heating of dynamos in continuous operation. The notes appear to be quite valuable, but are too mathematical to be abstracted.—*Elek. Zeit.*, June 28, July 5.

Paralleling Alternators.—Kowaleff.—An illustrated description of an electric indicator which allows in an easy way to measure the relative differences in the positions of the cranks of engines coupled to alternators working in parallel. The device consists of a voltmeter, calibrated in a special manner, and of small switches applied to each engine so that the switching occurs in the moments corresponding to two certain and opposite positions of the crank, for instance, when it is at the dead centres in one revolution.—*Elek. Zeit.*, June 21.

Single-Phase Motors.—Wilmshurst.—A reprint of the paper abstracted in the Digest, July 21.—*El'ty*, July 18.

Design for a Simple Transformer in Four Sizes.—Poole.—A design for a core-type transformer in 200 watt, 500 watt, 750 watt and 1000-watt sizes. The primary is sub-divided so that the transformer can take current from a 200, 400 or 1000-volt circuit; the secondary is sub-divided so that the transformer can deliver its full output at 18 and 32 volts, 32 and 36 volts, 50 volts, 32 and 50 volts, 100 volts, or 32, 50, and 100 volts.—*Amer. Elec.*, July.

Lights and Lighting.

Visible Radiation from Carbon.—Nichols.—A brief abstract of a paper read before the Am. Ass'n for the Advanc. of Science. The radiation from carbons of the types used in incandescent lamp filaments is not of the same type as that from a perfectly black body, but the radiation is selective, the radiation from that part of the spectrum between the red and the yellow being much greater than it is in the case of a black body.—*Science*, July 20.

REFERENCES.

Canal Lighting.—In the continuation of the account of the proceedings at the recent annual meeting of the Union of German Elec. Eng. (Digest, July 28), an illustrated description of the lighting plant of the Kaiser Wilhelm Canal is given, which was referred to in the Digest, July 21.—Lond. *Elec. Eng.*, July 13.

Twin Carbon Arc Lamp.—An illustrated description of the arc lamp of Koerting and Mathiessen, noticed in the Digest, Feb. 10.—Lond. *Elec. Rev.*, July 13.

Power.

Gas Engines for Electrical Purposes.—An editorial pointing out that in some respects the gas engine is particularly suited for electric traction work. A gas engine capable of producing, say, 80 kilowatts as a maximum, may be found capable of dealing with a peak of 100 kilowatts, for the peak would be momentary. It would be dealt with by the fly-wheel energy superadded to the full effort of the engine, and it would cease before the speed of revolution had fallen very seriously below the normal. No prospect of success is seen for gas engines using other than producer or similar gas. Gas producers should be designed very carefully. Each pound of fuel consumed in a blast furnace, after it has done its work of producing iron, renders up by means of gas engines power of greater amount than if converted into steam power by means of steam engines of the highest class.—Lond. *Elec. Rev.*, July 13.

REFERENCES.

Swiss Water-Power Plant.—A brief note stating that the water-power station at Thuzy-Hauterive is to be opened at the beginning of next year, and will furnish power to various works in the district at from $18 to $23 per horse-power per year, instead of from $32 to $36, which is the present rate. This reduced tariff is expected to make the use of electric power possible for driving machines in agricultural undertakings, such as threshers, straw-cutters, stone-breakers, etc.—Lond. *Elec. Eng.*, July 13.

Water-Power Plant.—An illustrated article on the hydraulic work

of the extended water-power plant proposed to install at Shawinigan Falls, Canada. The normal fall of the St. Maurice River at this point is 24,000 cu. ft. per second, and 100,000 horse-power can be developed and utilized at the very lowest water.—*Can. Elec. News,* July.

Generation of Energy.—ADAMS.—A general article on "twentieth century energy," discussing the efficiency of steam engines and gas engines and the production and properties of producer gas.—*Sc. Amer.,* July 14.

Power Schemes in Great Britain.—Continuations and conclusion of the serial (Digest, May 26), on projected electrical power schemes, giving maps of the areas to be supplied and some information about the promoters and the financial conditions of the schemes. —Lond. *Elec.,* May 11, June 1, July 13.

Efficiency of the Steam Engine.—DE SEGUNDO.—A reprint of the paper abstracted in the Digest, July 14.—*El'ty,* July 18.

Electric Trolley Hoist.—Two illustrations, with brief description, of a new electric trolley hoist, made by the Sprague Co.—*Am. Mach.,* July 19.

TRACTION.

Electrolysis of Underground Metal Structures by Tramway Return Currents.—MAURY.—A long, illustrated paper, read before the American Water-Works Ass'n at Richmond. He describes some instances of electrolytic injury, discusses at some length the electric resistance of the joints of cast-iron mains, and points out the important bearing which this joint resistance has upon various remedies for electrolysis heretofore suggested; he shows from actual cases the detrimental results which must certainly follow, if cast-iron mains are used to convey electric current. He concludes that the return currents must be kept out of the ground, and that this may be done either by using double overhead trolley system, as in Cincinnati and Washington, or by using the conduit system, with both the outgoing and the return conducting wires laid in the conduit. (The method of negative boosters is not referred to; see the abstract of the paper of Teichmueller, Digest, June 23).—*Eng. News,* July 19.

Electric Traction.—R. KENNEDY.—A brief article, in which he agrees with the opinion, recently expressed by A. A. C. Swinton, as to trolley and conduit traction, that while it would have its day, the motor car would eventually drive it out. He thinks it is a wrong course in attempting long-distance, fast-speed motor cars on common roads; the big field for motor cars is said to be "in towns and cities on a smooth, steel plate rail carrying a constant stream of paying customers 16 hours a day in a well-managed, orderly manner;" in good, paved streets no plate or rail would be necessary. At present the internal combustion motor is foremost for light vehicles and boats, being by far the cheapest and lightest motor; but for luxurious traveling, short distances, with silence and cleanliness, nothing can be better than the electric-battery car, although it is expensive to run. —Lond. *Elec. Rev.,* July 13.

Snow Sweeping.—A note on a car, used by the Budapest Tramway Co., during last winter for clearing the lines of snow. Under an ordinary tram-car frame, both back and front, cylindrical brushes were placed, which were made to revolve rapidly by a 20-kw, series motor. The car was driven at a speed of from 5 to 7½ miles per hour by the aid of two 20-kw motors. The motors for propelling the car and for operating the brushes were independent of each other.—Lond. *Elec. Eng.,* July 13.

REFERENCES.

Polyphase Traction.—KANDO.—A communication referring to the paper of Reichel (abstracted in the Digest, June 30), and claiming the priority in the use of high-tension, polyphase currents for traction purposes for Ganz & Co.—*Elek. Zeit.,* June 21.

REICHEL.—A reply to this criticism. The important result of the experiments of Siemens & Halske is said to be the design of an efficient sliding contact which allows to supply three-phase currents at 10,000 volts, without transformation, to the cars running at high speed.—*Elek. Zeit.,* July 5.

Automobile.—An illustrated article, giving a description and a working drawing of an electric phaeton for two persons.—*The Hub*; *Sc. Amer. Sup.,* July 14.

English Tramway Exposition.—An illustrated article on this exposition, noticed in the Digest, July 21 and 28.—*St. R'y Rev.,* July.

Power-House Diagrams.—Diagrams, with brief description, taken from the power-house records of three British tramways from Dec. 1, 1899, to March 31. They show the total car miles run on each day during this period, the total number of units generated for all purposes, and the ratio of the two amounts. The effect of snow and fog is plainly shown.—Lond. *Elec.,* July 13.

Transition Curves.—Elaborate tables for transition curves, with description, prepared by the civil engineering department of the Boston Elevated Railway.—*St. R'y Rev.,* July.

Glasgow.—An abstract of the report of the Glasgow tramway committee for the year ended May last. The trolley system is being introduced; the far greater part of the lines is, however, still worked by horses. In the electric traction section, the proportion of working expenses to receipts is 45 per cent; in the horse section, this proportion is 77 per cent.—Lond. *Elec. Rev.,* July 13.

Chicago.—A well-illustrated description of the power station of the Northwestern Elevated Railroad of Chicago.—*St. R'y Rev.,* July.

Basel.—A long abstract of the annual report for 1899 of the electric tramway lines of Basel.—*Elek. Zeit.,* June 28.

Glasgow.—YOUNG.—His paper in full on "the functions of modern tramways, and what Glasgow is doing towards their fulfillment," an abstract of which was noticed in the Digest, July 28.—*St. R'y Rev.,* July.

INSTALLATIONS. SYSTEMS AND APPLIANCES.

Central-Station Statistics for Germany.—The very complete, annual statistics, in form of 19 full-page tables, with an editorial summary. They give the data up to Mar. 1, 1900. (The statistics up to Mar. 1, 1899, were abstracted in the Digest, Aug. 5, 1899.) Included are all public central stations and those of isolated stations which give current also for public lighting; other isolated stations and all plants for traction purposes only are excluded. A new column gives the number of meters in use; it relates, however, to the midst of 1899, and is not so complete as the other statistics. From Mar. 1, 1899, to Mar. 1, 1900, 163 new stations were opened, making the total 652 against 489; 122 were in course of erection. Some stations supply current to quite a number of towns in a circular area with a diameter of 12 to 19 miles; in some cases there are up to 30 towns supplied from one plant. While the number of electric stations is not yet equal to that of gas plants, the number of towns with electric light is now about 900 against about 850 towns with gas light. Direct current is used in 80.4 per cent of all stations, their capacity is 53.8 per cent of the total of all stations, against 80.6 and 62.3 respectively in 1899. The number and capacity of single-phase and three-phase alternating-current plants have increased only slightly, while there is a great increase in the number and capacity of stations with mixed systems, in which both direct and alternating current are generated, or in which alternating current is used for transmission and direct current for distribution; 93.1 per cent of the direct-current stations are supplied with storage batteries; the capacity of the batteries is 27.5 per cent of the total capacity of the direct-current stations. In 42 stations (against 33 in 1899) single-phase and two-phase currents are used, their capacity is 21,573 kilowatts, against 17,826 in 1899. The number of three-phase stations has increased from 33 to 39, their capacity from 29,715 kilowatts to 35,150 kilowatts, that is, 18.3 per cent, while the increase in 1899 was 109 per cent. The number of combined three-phase and direct-current stations has increased from 22 to 38, their capacity from 25,970 kilowatts to 46,608 kilowatts. The number of combined single-phase alternating and direct-current stations has increased from 5 to 6, their capacity from 1011 kilowatts to 1700 kilowatts. In two stations of, together, 790 kilowatts, the monocyclic system is used. Steam is used exclusively in 58.6 per cent of all stations, and the capacity of these stations is 76.5 per cent of the total capacity of all stations. Water-power is used exclusively in 11.4 per cent of all stations, with a capacity of 8.2 per cent of the total capacity of all stations; among the 74 water-power plants is the greatest electric plant of Germany, at Rheinfelden, with 12,000 kilowatts; the other 73 water-power plants are very small stations. In 144 stations, with 26,674 kilowatts capacity, both water-power and steam are used. The number of stations operated by gas has increased from 21 to 29, but their capacity is still only 1 per cent of that of all stations; 306 stations have a capacity of 100 kilowatts or less, 249 stations between 101 and 500 kilowatts, 31 stations between 501 and 1000 kilowatts, 29 between 1001 and 2000 kilowatts, 17 between 2001 and 5000 kilowatts, 6 more than 5000 kilowatts. The increase in the number of incandescent lamps is 35.2 per cent, arc lamps 21.6 per cent, and in the horse-power of motors 55 per cent (against 36, 26, 91.3 respectively from 1898 to 1899). Counting 10 standard incandescent lamps at 50 watts for one arc, and 18 for one horse-power of motor, the total connections to the stations amount to 5,039,217 standard lamps (against 3,587,235 in 1899) or 251,961 kilowatts, while the total capacity of all stations is 230,058 kilowatts. The total connections of all stations have increased by 40.5 per cent, the total capacity by 36.7 per cent; 463 stations are owned by private companies, 166 by municipalities.

Some of the stations owned by municipalities are rented to private companies.—*Elek. Zeit.*, July 5.

Distribution of Electricity in Hastings.—ANDREWS.—A paper read before the Brit. Munic. Elec. Ass'n, discussing the old question of alternating currents versus continuous for a district covering an area of a few square miles, but very sparsely populated. He takes the case of the borough of Hastings, and gives tables as to the capital outlay and the annual cost of upkeep, showing that it was there more economical to install an alternating-current supply. Current at 2000 volts, generated in the power house, is transmitted to transformer sub-stations for transforming down for distribution on a three-wire system. To insure reliability of working, apparateus and feeders are duplicated throughout, and it is arranged that in the event of a failure, the faulty section will be automatically disconnected from the system, the duplicate feeder being left to maintain the supply. The adjoining figure shows the connections, both primary and secondary in the sub-stations. *F* and *F*1 represent the duplicate high-tension feeders entering the sub-station from the generating station. *F*2 and *F*3 are

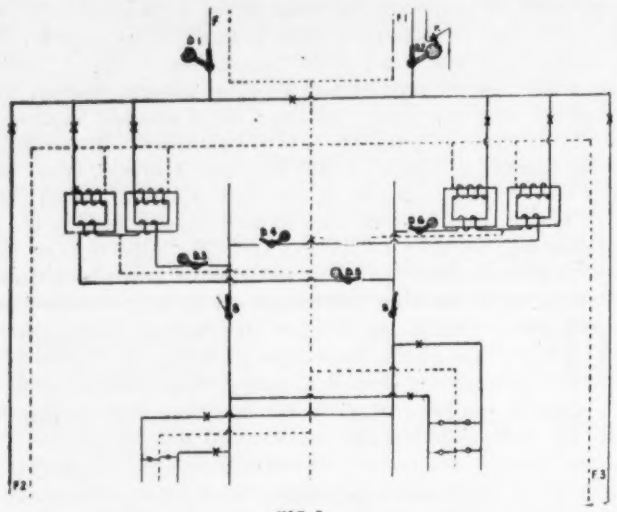


FIG 1.

similar feeders leaving to supply other sub-stations. *D*1 and *D*2 are high-tension, discriminating cut-outs connected to the end of each feeder to prevent a heavy current from returning via the sub-station to supply current to a faulty feeder. *D*3, *D*4, etc., are similar cut-outs on the secondaries of transformers; they serve to disconnect a faulty transformer from the secondary bus-bar, and so prevent it from short-circuiting the remaining healthy transformers. *S S* is a double-pole switch inserted in series with the secondary bus-bar; by opening it, the secondaries of all transformers are disconnected from the distributing network. Each distributor with its branches runs from one sub-station to another, and as all distributors are heavily fused at each end, a heavy short-circuit on any section of the network will cut the distributor affected free from the rest of the system. The district supplied is divided into four distinct secondary networks. Each distributor is connected, either directly, or via other distributors and sub-stations, to the generating station. One object of this arrangement is to enable the entire district to be supplied during the hours of light load by means of the secondary network only. As soon as the load falls below a certain point every night, the transformers and feeders are turned off, and they are not turned on again until the load begins to rise in the morning. The turning on is done from the generating station in the manner illustrated by the adjoining figure. From each sub-station a pilot wire, *P*, is run direct to the generating station, to be used for the following purposes: (1) To indicate on a voltmeter, *V*, at the generating station, the pressure of the sub-station; (2) to indicate at the generating station the position of any fault in a transformer or feeder; for this purpose a small auxiliary switch is attached to each of the discriminating cut-outs in such a manner that it is opened or closed by the opening or closing of the cut-outs; these auxiliary switches, *K*, *K*1, *K*2, are all connected in series with the pivot wire, so that if a fault occurs in any high-tension feeder or in a transformer, the cut-out directly connected to it is opened thereby, and the needle of the voltmeter falls to zero; (3) to indicate at the generating station when the secondaries of the transformers have been disconnected at the respective sub-stations, which is done by means of the double-pole switch, *S S*; this is weighted in such a manner that it tends to stay closed; by lifting the weight the switch is opened, and it may be kept open by means of the small catch, *R*; by lifting *R*, the pilot-wire circuit is interrupted; (4) to enable the secondaries of transformers at the sub-stations to be switched on to the distributors from the generating station, which is done by placing the switch, *D*, over to make contact with the wire, *A*, a current then passes through the coil, *E*, so that the catch, *R*, is released and the switch, *S*, is closed; the switch, *D*, is then replaced, so that the voltmeter indicates the pressure at the transformer station.—Lond. *Elec. Eng.*, July 13.

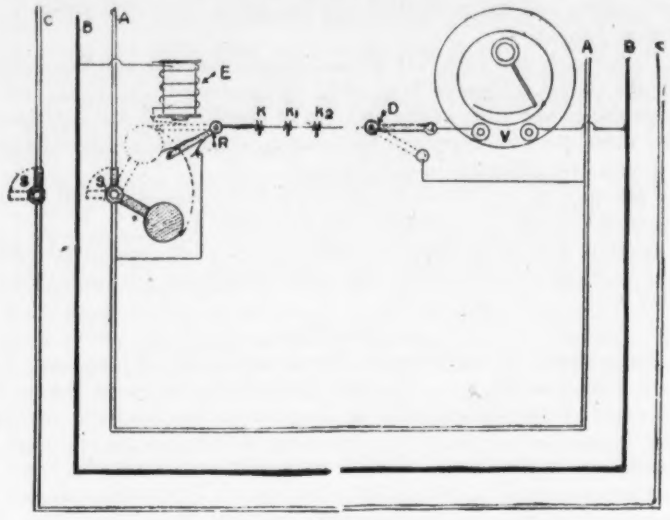


FIG 2.

Utilizing the Energy Lost in Resistances.—A. H.—An article, illustrated by diagrams, in which he suggests to utilize the energy lost in auxiliary resistances, as used for regulating the speed of motors, for steadying the light of arc lamps, etc. For instance, as resistance for regulating the speed of a fan motor, he proposes to use a small incandescent lamp, placed in a room not too far away from the motor; at the side of this lamp supplied with the motor current, he suggests to place another lamp supplied with current direct from the supply network; the connections are made so that as soon as the small lamp used as resistance for the motor is switched out, the other lamp, connected to the supply network, is switched in, and an arrangement is made so that it is impossible that the two lamps are alight at the same time. As steadying resistance for arc light, he suggests to use the coils of a cooking apparatus, etc.—*Elek. Anz.*, June 14.

Buenos Ayres.—The first part of an illustrated article on the electric plant of Buenos Ayres. In the new station, the electric equipment of which was furnished by the Union Elec. Co. of Berlin (which is affiliated with the General Electric Co. of this country), the monocyclic, alternating-current system is used, owing to its advantages where the distribution of energy for lighting is the principal consideration, and where the demand for motive power is small or remains to be developed. Current is generated at 3500 volts and transmitted to 50 sub-stations scattered all over the city, where it is transformed down for distribution to the consumers on a three-wire system, with 230 volts between the outers.—Lond. *Elec. Rev.*, July 13.

Electricity in Mines.—An account of the development of the electric installations in the mining district of Saarbruecken, Germany. Until 1894, electricity was used there only for lighting; since that time, 10 plants for power purposes have been erected. For lighting, a tension of 110 volts is used throughout. In recent years experiments were made with portable mining lamps, provided with storage batteries; for special purposes their use is much recommended, while for general use they are too expensive. Of the electric plants for power purposes, 5 are operated with direct current at 220 to 440 volts, and 5 with three-phase current at 500 to 2000 volts; they are used especially for traction purposes and for driving the ventilators. An electric pumping station of 300 horse-power is projected, with three-phase currents of 5000 volts.—*Elek. Zeit.*, June 28.

Electric Plants for Small Towns.—An editorial referring to the papers of Brown and Harris (Digest, July 14). For many small towns separate electric stations would not be profitable, and it is better for them to wait until they are absorbed into the supply system of a large power-distribution scheme. The designs of a plant and of the future extensions should be placed, not into the hands of the residing engineer, but of an outside consulting engineer. The suggestion of Edgcome that it would be an admirable office for the Municipal Elec. Ass'n to supply the names of competent consulting

engineers is unfavorably criticized. Independent private action is, in the ranks of consulting engineers, the most satisfactory course for both consultants and clients.—Lond. *Elec.*, July 13.

REFERENCES.

Three-Phase Plant.—A note on the opening of the three-phase plan of Asnieres, which will have a total capacity, when completed, of 20,000 kilowatts. Current will be supplied to the network of a Paris central station, the machines of which have proved insufficient, and besides to some large consumers. There are at present two sets of alternators installed, each consisting of two dynamos, each of 1000 kilowatts, and generating three-phase current at 5000 volts and of 25 p. p. s.—*L'Ind. Elec.*, June 25.

Willesden.—An article on the scheme of electric lighting and traction for Willesden. In the power house, three-phase currents at 3000 volts will be generated and transmitted to sub-stations for conversion into direct current by means of motor generators. The distribution will be on the three-wire system, with 480 volts between the outers. The tramways will be supplied at 500 volts.—Lond. *Elec. Eng.*, July 13.

Montreal.—An illustrated description of the alternating-current plant of the Imperial Electric Light Company, of Montreal.—*Can. Elec. News*, July.

Small Plants.—ADAMS.—An article on "diverse service for small stations." The 450 to 500-volt, direct-current, three-wire system, is discussed. The flexibility, reliability and economy inherent in a single type of main-generating equipment at central stations, are said to be sufficient to warrant the addition of more or less auxiliary apparatus at the plant for the purposes of distribution to the more distant loads; he discusses how that may be done in different cases.—*Elec. Rev.*, July 18.

Storage Batteries.—Three brief communications, illustrated by diagrams, describing the arrangement in an installation where the usual power absorbed is 150 horse-power, but at times 250 horse-power are required, while the generators give only 200 horse-power, the difference being supplied by a storage battery, run in parallel with the generators.—Lond. *Elec. Eng.*, July 13.

Lightning Arresters.—An illustrated description of different types of Wurts lightning arresters for direct-current circuits.—*Elec. Rev.*, July 18.

Fuse Box.—Descriptions and sketches of a double-pole fuse box for house service, to carry up to 50 amperes.—Lond. *Elec. Eng.*, July 6.

ELECTRO-PHYSICS AND MAGNETISM.

Discontinuity of Cathode Radiation.—VILLARD.—An account of experiments showing that cathode rays may have a strong tendency to discharge themselves intermittently. He makes a cathode beam rotate about its axis by means of a revolving magnetic field. While a continuous beam would then describe a circle on a fluorescent screen, a cathode beam only produces a series of patches arranged on the circumference of a circle. When the tube is worked by an alternating current, each active semi-period is thus broken up into a series of equidistant discharges.—*Comptes Rendus*, June 25; abstracted in Lond. *Elec.*, July 13.

Electrical Transparency of Liquids.—DE HEEN.—A French Academy paper, giving an account of an investigation of the transparency of liquids for electric waves. All the liquids examined could be divided pretty sharply into two classes, the transparent and the opaque, respectively. The transparent are ether, petroleum, benzine, xylene and butyric and valerianic acids. Opaque are water, alcohol, aldehyde, carbon bisulphide and ethyl bromide. This classification shows no connection with other physical properties. The transparency of ether is reduced from 1232 arbitrary units to 73 by adding 30 per cent of its volume of alcohol, and to zero by adding 43 per cent.—*Comptes Rendus*, May 28; abstracted in Lond. *Elec.*, July 13.

Electromagnetic Rotation of Light.—FESSENDEN.—A very brief abstract of a paper read before the Am. Ass'n for the Advanc. of Science, in which he gave "a new theory of the electromagnetic rotation of light." He showed that whenever light is absorbed, certain phase relations between the electric and magnetic forces and fluxes in the wave are shifted in such a way as to make the plane of the wave rotate when placed in a magnetic field. Evidence was given tending to show that this is a sufficient and probable explanation of the phenomenon.—*Science*, July 20.

Permanent Magnets.—FRANK.—An account of an investigation of the various conditions affecting the permanency and the moment of a steel magnet. A number of magnets were prepared of the same piece of English silver steel; they were chilled from several high temperatures, ranging from a dull red to a white heat, and then magnetized by the same current and coil. The influence of the temperature is very considerable. The highest magnetic moment is obtained by chilling from a normal red heat, midway between the dull red and the white; it is double that obtained after heating to dull red, and 30 per cent higher than that obtained after heating to a white heat. The duration of the heating seems to have no influence whatever. The temperature at which the magnetization itself is carried out has some influence; if carried out at a low temperature, the moment obtained is higher than if the magnetization takes place at say 100 degs.; but this difference is small when the steel has been chilled from a bright red or a white heat. The "loose magnetism" is more easily got rid of when the chilling takes place from a low heat than from a high one, and Barus and Strouhal's methods of ageing magnets, either by boiling or by cycles of temperature, appear to be the best all round.—*Ann. der Physik*, No. 6; abstracted in Lond. *Elec.*, July 13.

REFERENCES.

Theory of Electromagnetic Waves.—HEAVISIDE.—Continuations of his serial, forming a part of the third volume of his work. (Digest, Mar. 31.)—Lond. *Elec.*, Mar. 23, Apr. 20, June 8, July 13.

Cathode Rays.—MERRITT.—The paper in full, read before the Am. Ass'n for the Advanc. of Science, which was abstracted in the ELEC. WORLD AND ENG., July 14.—*Science*, July 20.

Lightning.—ROLLINS.—A continuation of his serial, referring to a photograph which is said to show to the left of a bright lightning flash a dark band. He says, this is a place in the ether swept so nearly clean of matter that it neither conducts nor shines well.—*Elec. Rev.*, July 18.

Magnetic Whirl in a Conductor.—JAUMANN.—An illustrated abstract of his paper, describing a magnetic flag for the demonstration of the magnetic whirl (Digest, July 14).—*Elek. Zeit.*, June 28.

ELECTRO CHEMISTRY AND BATTERIES.

REFERENCES.

Lead-Peroxide-Zinc Cells.—MUELLER.—A longer, English abstract of the German article noticed in the Digest, June 9.—Lond. *Elec.*, July 13.

Reducing Action of Electrolytically-Deposited Metals.—BINZ and HAGENBACH.—A longer abstract of the paper noticed in the Digest, Dec. 2.—Lond. *Elec. Eng.*, July 13.

Engraving by Electricity.—A brief, illustrated article on the method noticed in the Digest, Jan. 13, Apr. 21, May 12.—*Sc. Amer.*, July 14.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Low-Temperature Photometry.—LUMMER and KURLBAUM.—An account of an investigation of the manner in which the brightness of a luminous body increases with the temperature. They compare the radiation of a "black" hollow space at various temperatures with that of a piece of platinum foil kept at a constant temperature, and reduce the radiations to apparent equality by means of Abney's revolving sector. They express the relation between brightness and temperature by an equation stating that the ratio of two values of brightness is equal to the x*th* power of the ratio of the corresponding absolute temperatures, and determine the variation of the co-efficient x with the temperature. "This coefficient has at low temperatures an extraordinarily high value, being 30 at 900 degs. abs., 25 at 1000 degs., and 15 at 1600 degs. This circumstance is greatly in favor of photometric measurements of temperature."—*Verhandl. Deut. Phys. Ges.*, v. 2, No. 8; abstracted in Lond. *Elec.*, July 13.

Magnetic Shielding.—DU BOIS and WILLS.—The fifth part of their serial. If a double shell is not sufficient for shielding a galvanometer or other apparatus, a trilamellar shell is to be used. They give an account of theoretical and practical researches as to the relative thickness of the single shells, which should be about 15 per cent of the radius for cylindrical shells and 10 per cent of the radius for spherical shells.—*Ann. der Physik.*, v. 2, p. 78; abstracted in *Elek. Zeit.*, June 28.

REFERENCES.

Measuring Instrument for Automobiles.—An illustrated description of a combined volt and ammeter of Hartmann & Braun, for use on automobiles, designed after the principle of the Deprez-d'Arsonval galvanometer.—*Elek. Zeit.*, June 21.

Electric Measuring Instruments.—STEVENS.—The first part of a reprint of his Franklin Inst. paper, abstracted in the Digest, July 28.—*St. R'y Rev.*, July.

Measuring Instruments for Telegraphic Lines.—BREISIG.—An illustrated paper, read before the Electrotechnical Society of Berlin, in which he describes a universal instrument which allows a great many measurements for telegraphic lines.—*Elek. Zeit.*, June 28.

Wehnelt Interrupter for Spectroscopic Measurements.—HOPPE.—An article describing experiments in which he obtained, with a specially-constructed Wehnelt interrupter, beautiful spectra of mercury, and of solutions of sulphates of copper, iron and zinc.—*Elek. Zeit.*, June 21.

Photometry of Arc Lamps.—CARTER.—The first part of an illustrated article in which he points out the importance of photometric tests of arc lamps for central stations, and gives hints how to carry them out. A large room should be available for the tests; a passage 6 ft. or 8 ft. wide, 12 ft. high, and 12 yards or so long, makes an excellent photometer room. The simplest arrangement of the apparatus in a photometer room is shown in two diagrams.—Lond. *Elec. Rev.*, July 13.

Meters.—Two communications, by Uppenborn and F. Kohlrausch, continuing their controversy.—*Elek. Zeit.*, June 21.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Luminosity Effects on the Mast Wire.—TOMMASINA.—An account of an investigation of the effects observed in the mast-head wire which is used in Marconi telegraphy. The same is known to give out a slight rustling noise when in action. By inserting in it a short length of thin wire enclosed in a light, tight box, luminous brushes appear, which he photographed. The brushes vibrate in unison, not with the oscillator, but with the interrupter of the induction coil. When both are in unison the brushes are distributed at regular intervals along the wire. He photographed them by placing a sensitive plate in immediate contact with the wire; the brushes then form straight lines normal to the wire.—*Comptes Rendus*, May 28; abstracted and commented upon in a separate editorial note in Lond. *Elec.*, July 13.

Telephonograph.—POULSEN.—A French Academy paper on his instrument, described in the Digest, June 23.—*Comptes Rendus*, June 25; briefly abstracted in Lond. *Elec.*, July 13.

In a separate editorial note the name "recording telephone" is suggested, and it is said that a cheap and efficient instrument of this kind would be a desiratum at the present time. Reference is made to a device of Kumberg which is based upon the simple principle that to an ordinary phonograph a loud-speaking telephone receiver is attached in place of the usual receiving diaphragm; the articulation obtained by his instrument is, however, most indistinct. Poulsen's instrument, while on view at the Paris Exposition, is not actually in operation there, as it was found too difficult at the exhibition to make the necessary adjustments in order that the working of the apparatus might be demonstrated to visitors; this is said to show in what experimental stage the invention still is.—Lond. *Elec.*, July 13.

Pollak-Virag System.—POLLAK and VIRAG.—A long communication replying to the criticism of Fleury (Digest, May 19, July 14). They add that in their high-speed system they do not any more transmit Morse signs, but in the receiving stations directly letters are printed. For printing one letter one or two or three current rushes are necessary. They claim that they can obtain now a speed of 50,000 to 60,000 words per hour, and that they have not yet reached the limit.—*Elek. Zeit.*, June 28.

The Telephone in the Electric-Light Plant.—WOODARD.—A brief article suggesting to connect in a country plant a telephone to one or all of the lines running out of the plant. When the engineer goes out, he may take along a magneto and a strong receiver, so that he can communicate with the station at any time by connecting to one line and to the ground through the instruments. In regard to the ground connection he has found that shoving a screwdriver into the ground 8 ins. to 12 ins. is generally sufficient.—*Elec. Rev.*, July 18.

REFERENCES.

Typewriting Telegraph.—SPAGNOLETTI.—A brief communication referring to the description of Steljes' typewriting telegraph, noticed in the Digest, July 28. The rate of speed of the transmission of a message by an unskilled operator varies from 14 to 18 words per minute; with very little practice 25 is easily obtained.—Lond. *Elec.*, July 6.

Interception of Wireless Telegrams.—TOMMASI.—An illustrated translation of the French paper, abstracted in the Digest, July 7.—Lond. *Elec. Rev.*, July 13.

Field Telegraphy in the War.—An account taken from a daily paper of the successful work of the engineers in supplying and maintaining the telegraph and telephone service between Mafeking and the outer forts and works during the siege under the most difficult conditions.—Lond. *Elec. Eng.*, July 6.

Cable to the Philippines.—HALE.—An article on the projected cable line to the Philippines.—*North Am. Rev.;* reprinted in abstract in *Elec. Rev.*, July 11, 18.

Fire Alarm.—MOLTKE.—A paper read before the recent annual convention of German Elec. Eng., in which he discussed in a general way what is required of the fire-alarm devices in larger cities, and spoke strongly in favor of electric devices.—*Elek. Zeit.*, June 21.

MISCELLANEOUS.

Australia.—BRAIN.—An abstract of his presidential address, held at the recent annual meeting of the New South Wales Elec. Ass'n. He dealt with the progress of electric engineering in Australia. The most important event in electric traction was the opening of the tramways in George Street, which was the first step towards an entirely electric system of tramways in Sydney; electric traction has been introduced also in Perth and Brisbane; the Westinghouse Company has secured the option of purchase of the Adelaide tramways, and proposes to electrically equip portions of track at Dunedin. The most interesting lighting event of the year in Australia was the installation of the Parsons steam turbine plant in a station at Melbourne; there are three turbine alternators installed, each consisting of a turbine coupled direct to a bipolar generator, the output of which is 150 kilowatts at 3000 r. p. m.; the supply is 2000-volt, single-phase, alternating current, with a periodicity of 50. He referred also to the signaling arrangements used on the New South Wales railways, to the development of telephony, and the electrical disposal of sewage.—Lond. *Elec. Eng.*, July 13.

Copper.—An article on copper production and consumption. For some years past the annual increase in the world's production of copper has varied but slightly from 10 per cent, which may be accepted almost as the normal rate in growth of production. The production of copper in the United States reached a total of 134,577 long tons for the half year ending June 30, 1900; the increase over the first half of 1899 was 10,030 tons, or only 8.1 per cent. It had been anticipated that the high price of copper would stimulate production very largely, and that mines would be opened in all parts of the world; but this has not been the case to any considerable extent in the United States. The consumptive demand in the United States has been fairly good this year, though hardly up to last year's standard. On the other hand, there has been an extraordinary demand for copper for export, and the total quantity shipped to foreign countries this year is 90,229 long tons, or 67 per cent of our total production; the exports were greater than those of 1899 by 21,945 tons, or 32.3 per cent, and were by far the largest ever reported. It is thought that these exports will continue large for the third and possibly for the fourth quarter of the year, and that they will support prices and will more than make up for any falling off in the home consumption.—*Eng. & Min. Jour.*, July 21.

REFERENCES.

American Engineers in England.—An editorial referring to recent visits of a large number of American engineers in England. "Fraternizing of this kind will teach both English and Americans how little is the real difference between the two great Anglo-Saxon empires and the best of their people."—Lond. *Elec. Rev.*, July 13.

American Engineering Competition.—A reprint of the first of a series of articles of the *London Times* on the engineering competition of the United States with Great Britain.—*Sc. Amer. Sup.*, July 21.

Curing Lupus.—A note on a method, devised by Morris, and put into systematic use in England, of curing lupus by means of electric arc light.—Lond. *Elec. Eng.*, July 13.

Railway Rates for Electric Machinery.—An article on the extremely high rates charged for forwarding electric machinery on British railways.—Lond. *Elec. Rev.*, July 13.

Paris Exposition.—A well-illustrated description of an alternator exhibited by the Helios Company, giving either 2000 kilovolt ampere single-phase current with a power factor of 0.7, or, at the same time, 1200 kilovolt ampere single-phase current and 1500 kilovolt ampere three-phase currents.—*Elek. Zeit.*, June 21.

An illustrated description of a 300-kw alternator exhibited by the General Electric Company, of Berlin.—Lond. *Elec. Rev.*, July 13.

A continuation of the illustrated serial, describing a 600-kw, Grammont alternator with a compound exciter, designed by Hutin and Leblanc.—Lond. *Elec. Eng.*, July 13.

An illustrated article on the illumination of the Palace of Electricity.—*Sc. Amer. Sup.*, July 14.

An illustrated note on the foreign section of the power plant.—*Sc. Amer. Sup.*, July 21.

An illustrated article on the mining and metallurgical exhibits.—*Eng. News*, July 19.

New Books.

THE ELECTROMAGNET. Edited by Townsend Wolcott. With Part II. By Richard Varley. Jersey City, N. J.: The Varley Duplex Magnet Company. 57 pages, 15 illustrations and chart. Price, $1.00.

This little book contains a very complete résumé of the principles of the electromagnet, which are treated under the heads of general properties, magnetic units, magnetic circuit, magnetic field and the calculation of magnetic windings. The greater portion of the space is given to the latter subject and the information included is of such a character as to be of much assistance in the design of electromagnets for different purposes. Part II. includes a number of formulas likely to be used in the design and application of electromagnets and also a reprint of the copper wire table of the American Institute of Electrical Engineers and other tables showing the relative space occupied by copper and insulation in silk and cotton-covered wires. The concluding pages contain what appears to be a reproduction of a slide rule scale, the object of printing which is not revealed in the accompanying obscure text.

GAS ENGINE CONSTRUCTION. A Practical Treatise Describing the Theory and Principles of the Action of Gas Engines of Various Types, and the Design and Construction of a Half Horse-Power Gas Engine. By Henry V. A. Parsell, Jr., and Arthur J. Weed. New York: Norman W. Henley & Co. 296 pages, 140 illustrations. Price, $2.50.

This book comprises 296 pages and 25 chapters, the first two of which are devoted to explanations on the principles of gas and hot-air engines, and are illustrated by photographs and wood cuts of existing engines. The illustrations also include drawings of parts, evidently taken from manufacturers' blue prints and diagrams.

The first portion of the subject matter of these paragraphs is devoted to historical and general principles, succeeding which comes a more elaborate discussion of modern methods and detail. To the novice these two chapters form a useful preface in enabling him to more clearly understand all the whys and wherefores of the design described in the next 204 pages.

The next chapters are devoted to illustrating and describing the manufacture of a small gas engine of about one-half horse-power capacity. This is taken up with a thoroughness rarely to be found in works of this character. Besides a clear and succinct description of each piece, and why it is made as it is, there follow working drawings of the piece itself, photographs of the actual process of shaping the piece in the lathe, and photographs of the completed parts, as well as of the various turning tools which are needed. All are illustrated and described in minute detail.

The person who desires to make such an engine, will find on consulting the book, not only careful and exact drawings of all parts, but profuse and well-illustrated details of how the machinist should finish them. For instance, the fly-wheel of the engine is illustrated in a working drawing which will be amply sufficient for the average machinist, and in addition a photograph of the pattern is shown together with no less than five different pictures illustrating the process of machining the fly-wheel into shape. In this respect the work is unexcelled.

Following the description of the engine is a chapter on regulating and starting gas engines; another on carbureters, and another on engine details and their design. The last chapter is unique in its character, for it consists of an annotated bibliography of gas-engine books and periodicals published in the English language, and is a brief review of the existing literature of the subject.

A complete index and a table of contents accompany the work. This book is valuable chiefly to those who intend to construct a small gas engine. The data and methods of construction and manufacture will evidently prove of value whether the design to be undertaken is that shown in this book or some other. It is a very desirable volume for those who wish to possess themselves of the first principles of both the theory and the practice of the internal combustion engine.

HORSELESS VEHICLES, AUTOMOBILES AND MOTOR-CYCLES. By Gardner D. Hiscox. New York: Norman W. Henley & Company. 459 pages, 316 illustrations. Price, $3.

The book is a compilation of extracts from manufacturers' catalogues, these being in many cases abstracted bodily. Interspersed will be found matter taken from French works on the subject of automobiles, together with a chapter of seven pages purporting to give directions for building an electric cab, with a one-page reduced working drawing of it. The title page calls the book "A practical treatise for automobilists, manufacturers, capitalists, investors and every one interested in the development, use and care of the automobile." It is feared that its scope is hardly as broad as this, but the work will undoubtedly be found of interest by those who contemplate designing and building a vehicle for themselves, as the author has with the description of almost every machine and part, furnished the name and address of its manufacturer.

The two addenda, one giving a list of United States patents on automobiles and running gear issued to date and the other giving a list of automobile manufacturers in this country with their addresses, are valuable features.

Directory of Electrical Societies, Etc.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Next meeting, Paris, Aug. 16, 1900.

CANADIAN ELECTRICAL ASSOCIATION. Next meeting, September, 1900. Place to be selected.

AMERICAN STREET RAILWAY ASSOCIATION. Next meeting, Kansas City, Mo., Oct., 16, 17, 18 and 19, 1900.

NATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Next meeting, Pittsburg, Pa., Sept., 25, 26 and 27, 1900.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Next meeting, New York, Sept. 25, 26 and 27, 1900.

THE ROENTGEN SOCIETY OF THE UNITED STATES. Next meeting, New York City, Dec. 13 and 14, 1900.

OHIO ELECTRIC LIGHT ASSOCIATION. Next meeting, Toledo, Ohio, Aug. 14-16, 1900.

OLD-TIME TELEGRAPHERS' ASSOCIATION AND THE U. S. MILITARY TELEGRAPH CORPS. Next meeting, Minneapolis, Minn., Sept. 18, 1900.

Electric Automobiles in Central Park.

The Park Commissioners of New York have granted permission to increase the service of public vehicles in Central Park by the addition of four electric automobile stages. The stages will be under the control of the same company that at present operates the horse 'busses, and are the first public automobiles that have been permitted to enter the park. The new stages will start at Seventy-Second Street and Fifth Avenue, and, after passing through the park, will run up Riverside Drive to Grant's Tomb.

A Loud Phonograph.

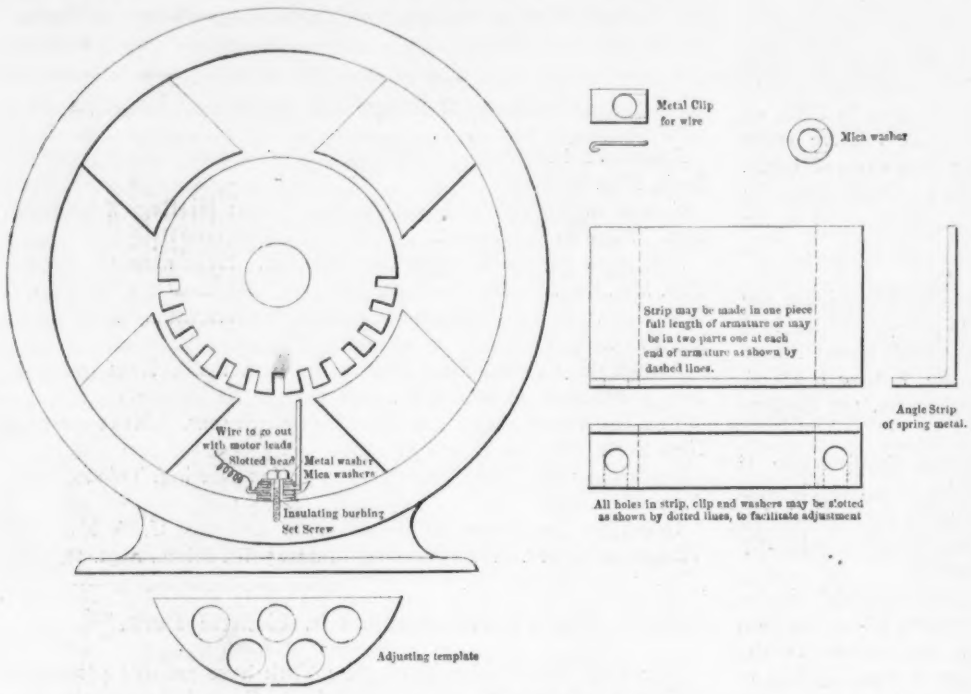
Mr. Horace L. Short, of Brighton, England, has invented a loud-speaking phonograph, which in appearance, is merely an ordinary phonograph, with a large trumpet, measuring 4 ft. in length. Inside this trumpet there is a small and delicate piece of mechanism that looks something like a whistle. This is the tongue of the machine. Instead of the "records" being taken on wax in the usual manner, a sapphire needle is made to cut the dots representing the sound vibrations on a silver cylinder, and when the needle travels over the metal a second time, the vibrations cause the whistle to produce a series of air waves, and the machine thus becomes a talking siren which transforms the human voice into a deafening roar. The experiments were made near the Devil's Dyke, Brighton, where the inventor has his workshops. The instrument was placed on the roof of the laboratory and was made to repeat a number of sentences. At a distance of ten miles the sounds were plainly heard by a large number of people, every word being perfectly distinct, and at a second trial, with a favorable wind, it was found that an unknown message could be taken down in shorthand at a distance of twelve miles. Over the water the sounds will carry still further, and under favorable circumstances they might easily be heard by persons on a vessel fifteen miles out at sea. Placed on a lighthouse or lightship the phonograph would give a verbal warning that would be infinitely more effective than the fog-horns and detonators at present in use.

Electric Railway Motor Low Bearings.

By Graham Bright.

THE subject, low bearings, is one that has troubled all street railway companies to a greater or less extent. At present there is no way of readily detecting a low bearing on a street car motor, the first indication being generally the blowing of the car fuse, caused by the armature rubbing on the lower pole-pieces and grounding the armature conductors as soon as the band wires are torn off. Very often by the time the car gets to the car barn, the conductors are completely torn from the slots and some of the teeth are often found forced together. Such a condition, of course, requires the armature to be entirely rewound. As an example of the expense incurred, a large traction company operating about 300 cars, from Jan. 1, 1900, to April 15, turned into the shop over 50 cars for repairs due to low bearings. Of these, one-third had to be completely rewound.

The following is a simple device which, when placed on a motor or dynamo, will detect a low bearing in time to prevent any damage done by the armature coming in contact with the pole-pieces. As shown in the figure, it consists of a strip of spring metal, bent at a right angle, and fastened to the yoke of the motor between the two lower poles in such a manner that, should the armature bearings wear down until the armature is near the pole-pieces, the teeth of the armature will strike the projecting strip. The metal strip is insulated from the motor frame by means of mica washers and bushings, and it is set in position by means of the template shown, so that its top point will be above the line of pole-pieces.


Metal Clip for wire
Mica washer
Strip may be made in one piece full length of armature or may be in two parts one at each end of armature as shown by dashed lines.
Angle Strip of spring metal.
All holes in strip, clip and washers may be slotted as shown by dotted lines, to facilitate adjustment
Wire to go out with motor leads
Slotted head
Metal washer
Mica washers
Insulating burbing
Set Screw
Adjusting template

DEVICE FOR DETECTION OF LOW BEARINGS.

Up in the car a signal is placed which will call the attention of the motorman or conductor when a bearing wears down. The signal may be a bell or a set of lamps. The current to operate the signal is either tapped from the car circuit below the overhead switch or from one pole of a dry battery placed on the car. After the current goes through the signal it is led, by a single wire, into the motor with the regular motor leads, and connected to the metal strip. When the armature strikes the strip the current finds a ground and the signal is operated. When a battery is used, the second pole of the battery must be grounded. It is seen from the above that the low bearing is detected before the armature has started to touch the poles. The motorman cuts the defective motor out and the car is turned into the repair shop to have new bearings put in. The metal strip may extend all the way across the armature, or two narrow strips may be used, one at each end of the armature. It may be mentioned here that the trouble from low bearings is much greater with high-speed than with low-speed traction.

"Supervisory" Telephone Exchange System at Lancaster, O.

One of the most interesting recent developments in the field of exchange telephony is that which has been introduced at Lancaster, O., as shown in the accompanying cuts, and which is now being installed for several other exchanges by the North Electric Company, of Cleveland, O., who call it the "North Supervisory System." Its features have attracted the attention of those who are investigating central-battery systems in general, and merit special comment and illustration. A more or less detailed account, with views of the apparatus, will be found herewith, in Figs. 1 to 7.

In this system, local talking batteries are used at the subscribers' stations; otherwise, all source of energy is at the central station. The subscriber calls up the central office by merely removing the receiver from the hook, and the operator, on answering with the plug, automatically restores the line signal to its normal position, also cutting in her "operator's set" so that she can give an immediate answer to the calling subscriber. On ascertaining the number desired, the operator inserts the corresponding plug into the multiple jack of the line desired and pulls the lever of her ringing key forward, thereby ringing the party desired. The operator is enabled at any time to ascertain just when the subscriber who is called answers, and in the event of a tardy response can give several rings without having to cut in her operator's set to ascertain whether the party has answered or not. She is also able to determine, by a glance at her supervisory signals,

FIG. 1—WALL TYPE TELEPHONE.

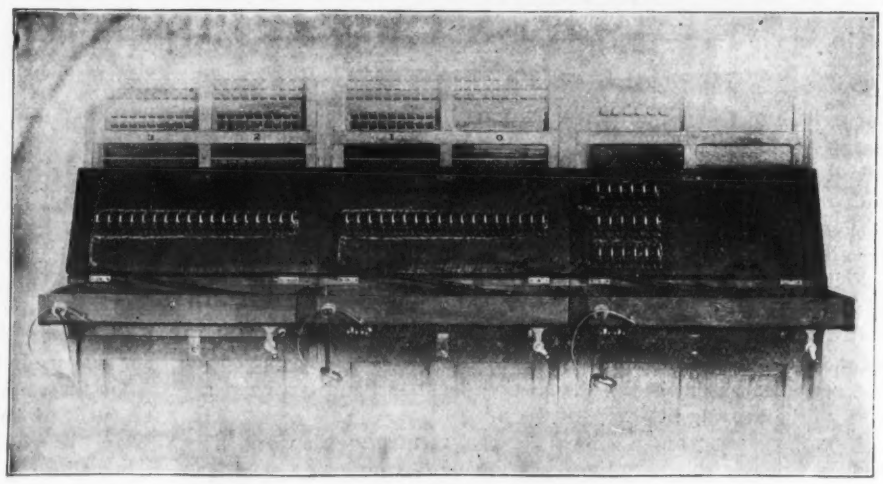


FIG. 2—KEY BOARD ARRANGEMENT.

whether the parties have finished their conversation, and whether either one wishes a second call.

It will thus be seen that the operator at no time has to cut her

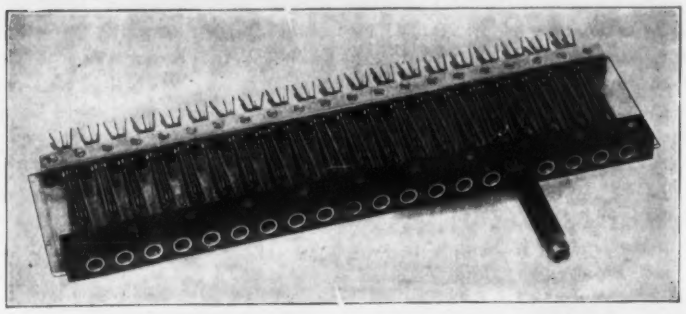


FIG. 3—MULTIPLE JACK.

operator's set into the line, except for the purpose of ascertaining the number, she always knowing whether both parties are talking, whether either party wants a subsequent call, and whether the called party has answered. This system differs, it will be noted, in that double supervision is offered, *i. e.*, a separate signal is furnished for each of the subscribers connected during a conversation. The line

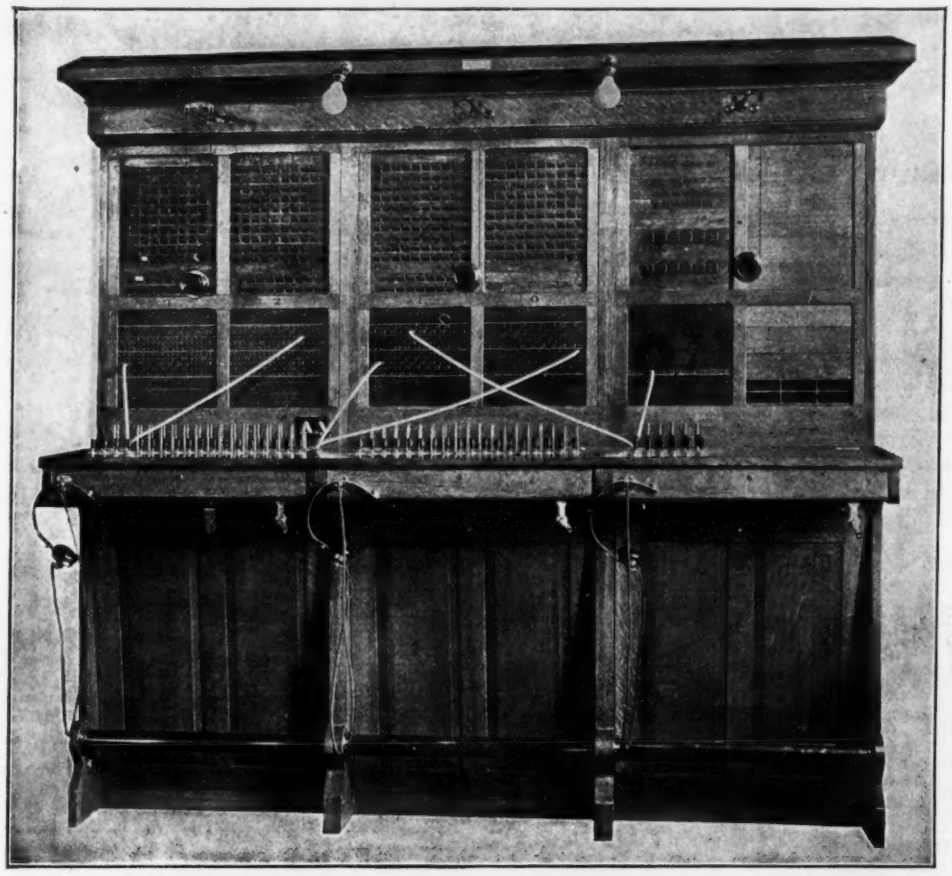


FIG. 4—400-SIGNALS INSTALLED, AND TOLL SECTION.

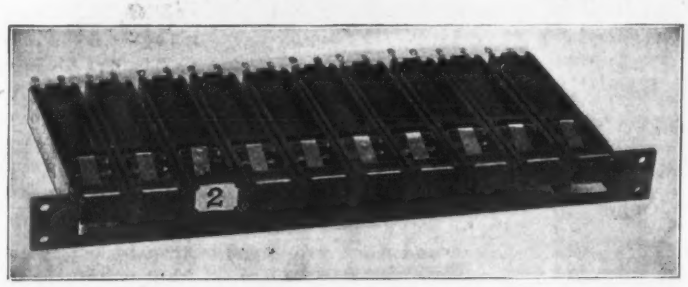


FIG. 5—LINE SIGNAL.

and supervisory signals used are of the gravity restoring type, as illustrated herewith, the signals being adjustable, so that they can be fitted to a wide range of line conditions. The signal is so unusually sensitive that it can be used on much longer lines than is found practicable in ordinary experience.

The wall type of telephone used in this system is exceedingly attractive, being small and compact, all parts of the mechanism used being easily accessible. Among the leading points emphasized in regard to this system is that the use of condensers, retardation coils, relays, etc., in connection with the talking circuit, either at the switchboard or telephone, is done away with, so that an exceedingly simple system has been evolved, and one which, if it accomplishes all that is claimed, should be very efficient and speedy. The manufacturers are building boards of this type for 200 lines to each operator, and they assert that this arrangement is perfectly practical. The answering jacks used in this system are mounted in banks of ten, the springs being made of the best German silver spring metal, with absolutely pure platinum contacts riveted in each spring. The jack springs are mounted in rubber, having mica insulation, and the whole is mounted on an aluminum base, thus giving a very rigid, and, at the same time, light bank of jacks. The multiple jacks are similar to the answering jacks except that they are mounted on one-half inch centres. Within the interior of the operator's keyboard a special system of switches is furnished for the toll-line section, thus making it possible to ring either way on the line, besides listening, and also to cut in a repeating coil, or switch the operator's set into such a position that she can assist the balance of the operators to answer their exchange calls on the local sections. Where through toll lines are used, the line is brought to a special triple jack, arranged so that it is possible for the exchange to get service on both legs of the toll line. A very efficient power equipment is furnished with this system, the

FIG. 6—INTERIOR VIEW OF WALL TELEPHONE.

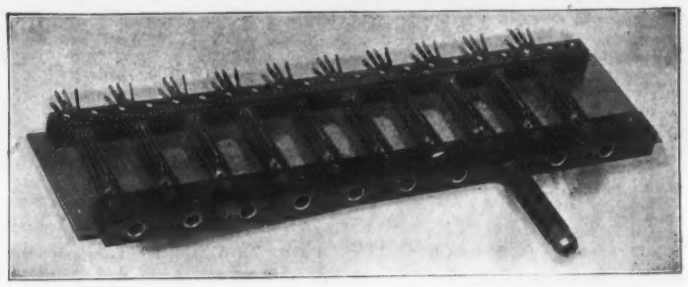


FIG. 7—LINE JACK.

power board being made of white marble on which are mounted the necessary switches, bus-bars, meters, etc.

The North Electric Company is working day and night to get out several large orders which have been placed with it for this system. As already stated, the board of which a view is shown, is installed at Lancaster, Ohio, and very satisfactory results are reported.

Bernard Enclosed Multipolar Motor.

In the accompanying illustration is shown the latest type of enclosed multipolar machine with exposed commutator, manufactured by the E. G. Bernard Company, Troy, N. Y. Fig. 1 shows the machine in its ventilated form, and Fig. 2 the same machine totally enclosed. These machines, which are fitted with reaction brush holders and self-oiling bearings, are adjustable to any position, and can be mounted direct to line shaft on the ceiling or side wall.

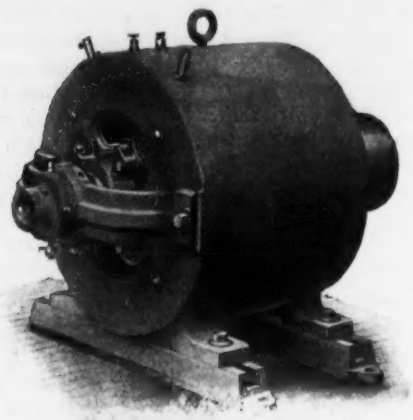


FIG. 1—VENTILATED MOTOR.

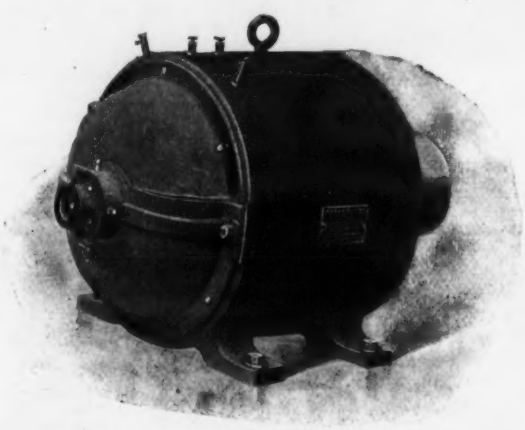


FIG. 2—ENCLOSED MOTOR.

Commutator and brushes are designed for 25 amperes per square inch maximum current density, thus insuring a cool commutator with carbon brushes. The motors have been designed also in accordance with the latest United States Government specifications. The bearings are self-oiling and furnished with bronze oil rings or bicycle chains, giving perfect and constant lubrication. Mica insulation is used throughout. They are normally furnished in ventilated form, shown in Fig. 1, but are also made as shown in Fig. 2, which style is principally used in mines and damp places. The form of construction admits of ready adaptation for connection either by belts, gears or direct attachment to lathes, planers, rolls, presses and machinery of all descriptions, including house water pumps, fans, elevators, etc. The motors are built in sizes from ½ to 35 horsepower at speeds varying from 150 to 1700 r. p. m.

Improved Oil Transformer.

The General Electric Company is now introducing an improved form of its type H oil transformer, which, in the original form, has now been on the market some four years. When brought out, it was regarded as a marked innovation in transformer practice, and the main features are retained, while the improvements now made along the same lines are such as to add to its efficiency and economy.

Among the more important features of the Type H transformer, the core may be noted first. It is built up of single rectangular punchings with interlocked joints. Each sheet is thoroughly insulated from the next, and the core is tightly held together without the use of bolts. The joints are so interlocked as to reduce the magnetizing current to a minimum and prevent vibration humming. The secondary coils are wound directly on the core; the primary coils directly on top of the secondary. This construction gives a most compact form of winding, avoids all waste space, and prevents vibration which might wear the insulation. The bounding surfaces between the primary and secondary are simple and cylindrical in outline, making it possible to provide a simple and most effective form of insulating shield between the high and low potential coils. The reversal of the

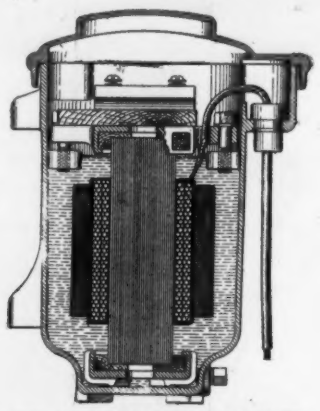


FIG. 2—TYPE H TRANSFORMER. SECTION THROUGH CASE, COILS, AND CORE.

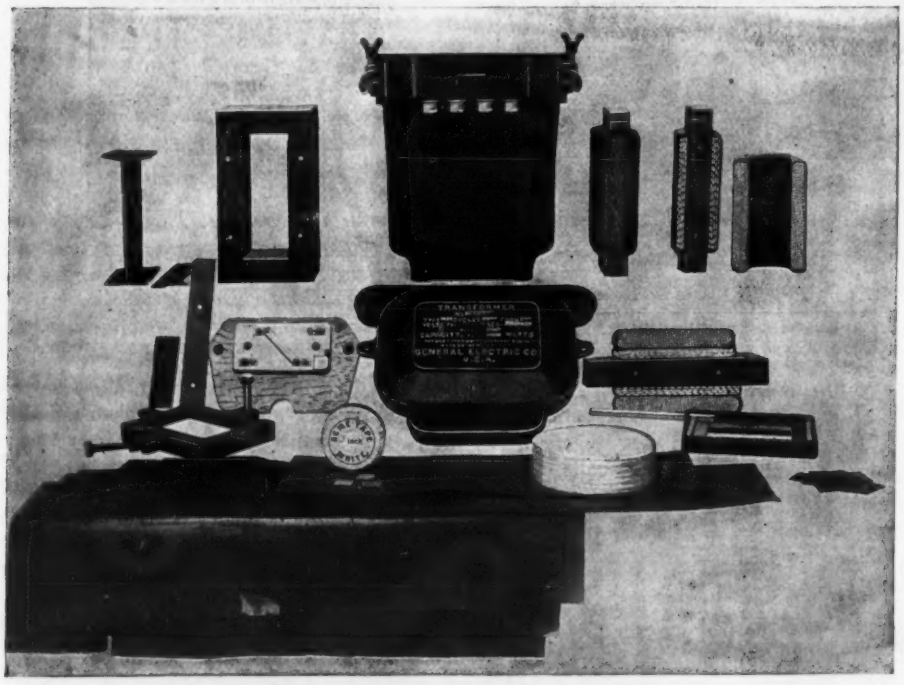


FIG. 1—PARTS OF TYPE H TRANSFORMER.

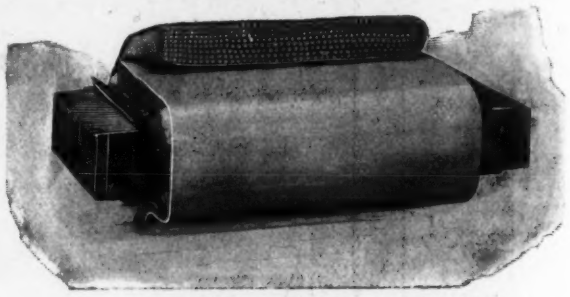


FIG. 3—COILS OF TYPE H TRANSFORMER.

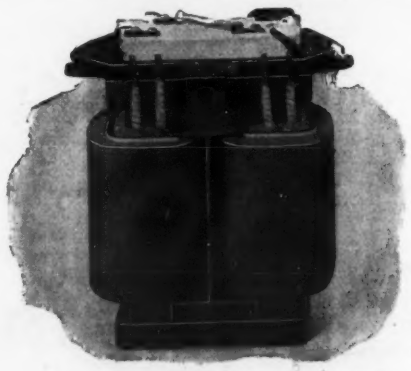


FIG. 4.—CORE TYPE H TRANSFORMER.

relative position of coils and iron in this type of transformer is very advantageous in the self-cooling transformer, as it insures the lowest possible temperature in the copper, compared with the other parts of the tranformer. The form of coils adopted is also such as to present a very large radiating surface to the oil. A very low temperature is obtained. The method of holding the transformer in the case is exceedingly simple and safe. Projecting pockets are also provided at the top of the case containing the porcelain bushings, through which

are brought out the primary and secondary leads. The construction admits of locating the bushing in a vertical position and safely protects it against mechanical injury in transportation. The arrangement, while simple in itself, is a great improvement in this important detail.

J. G. White & Company in England.

One of the leading electrical engineering concerns in the United States, J. G. White & Company, Inc., has now organized a company in London, to be known as J. G. White & Company, Ltd., which is to take over and carry on all the business opening up outside North America. The company has of late had a great deal of foreign work brought to it, much of which centers in financial London or has its origin there, and the new move is a necessary and even inevitable development of such a progressive policy as must be pursued by a company with engagements in all parts of the world. The new corporation has a capital stock of £100,000, or $500,000, divided into 5000 shares of £10, 6 per cent preference cumulative, and 50,000 ordinary of £1 each. The directors are J. G. White, Ph.D., chairman; managing director, O. H. Baldwin, M. E.; A. N. Connett, C. E., chief engineer; E. B. Wyman, and W. C. Burton electrical engineer. The secretary and treasurer of the company is A. H. Beatty. The mechanical engineer is E. P. Jones.

The organization thus created is one of unusual strength and ability. Mr. White, who is an engineering graduate of the Pennsylvania State College and Cornell, has carried out some of the heaviest electrical engineering done in this country, including railway work at Baltimore, Md. (about 200 miles); Buffalo and Niagara Falls, N. Y.; Washington, Charleston, Asheville, New Orleans, Nashville, Omaha, St. Joseph, St. Louis, Kansas City, Salt Lake City, Spokane, etc., and the designing and installation of a number of electric plants for lighting, and the installation of, or consulting engineering work for, such electric-power plants as those of the Niagara Power Company, complete designing and building of transmission line; subways for the Cataract Power & Conduit Company, Buffalo General Electric Company and city of Baltimore, and transmission plants in Helena and Cripple Creek. The work now being carried out by J. G. White & Company includes the following: Washington, D. C., equipment of about 60 miles of electric road; Toledo, O., to Detroit, Mich. (54 miles), complete engineering and construction of electric railway; Perth, Western Australia, consulting engineering and furnishing plant for tramways; San Juan, Porto Rico, complete engineering and installation of tramways and lighting plant; consulting engineering Alton (Ill.) Railway, Gas & Electric Company; Winston-Salem, N. C., consulting engineering Fries Manufacturing & Power Company, rebuilding and extending railway, etc.; Colorado Springs, Col., consulting engineering, rebuilding and extending railway, electric light plant and large new electric-power plant; Victoria, Australia, consulting engineering Deep Leads Electric Transmission Company (3000 horse-power); Western Australia, consulting engineering Kalgoorlie Electric Power & Lighting Corporation; State of New York, consulting engineering and valuation of properties for State Board of Tax Commissioners; St. Louis, Mo., consulting engineering Imperial Electric Light, Heat & Power Company, extension of plant, etc.

Mr. O. H. Baldwin, who is a graduate of the Stevens Institute of Technology, has been prominently associated with the Westinghouse Company for many years past, and for some ten years has had a large share in the direction of its engineering work in London. Mr. A. N. Connett is a graduate of the Rennsselaer Polytechnic Institute and has been actively engaged in electric railway work since 1889, and has carried out some large work, notably in Baltimore and Washington. Since 1896 he has been chief engineer of the Compagnie Française Thomson-Houston. While in Paris Mr. Connett has had charge of the numerous and large installations which have been made by his company. These have included the surface contact tramway at Monte Carlo, which has operated quite successfully, and was the first commercially successful tramway of this type in the world. Among his other installations the tramways at Nice, referred to in the Mescla article in this issue, are of particular interest. One of his most noted installations is the tramway in Paris, which is an unusual and improved type of conduit, and which is now operating very successfully. His work in France has included other tramway installations, most of which have been built on the overhead trolley system.

Mr. E. P. Jones, the mechanical engineer of the company, has had twenty years of practical work in mechanical engineering, chiefly in the United States, while of late he has been practising very successfully as a consulting mechanical engineer in Western Australia. The secretary of the company, Mr. A. H. Beatty, is an experienced accountant, and for some years has conducted investigations which required not only commercial skill, but ability in superintending electrical and engineering work. It will be seen, therefore, that each official is a picked man, and that the company is thoroughly entitled to the fullest confidence of capitalists, manufacturers and engineers, and is likely to develop a large business upon the important nucleus which it already has in hand. It will do no manufacturing whatever, but adhere strictly to the lines upon which it has been formed. A host of American friends will wish it abounding success.

Machine Tools for an English Electrical Factory.

Two special machines for the manufacture of armature disks and armature segments are shown in the accompanying half-tones. Their particular novel feature is the device for making them equally well adapted for cutting and notching the segments used in the con-

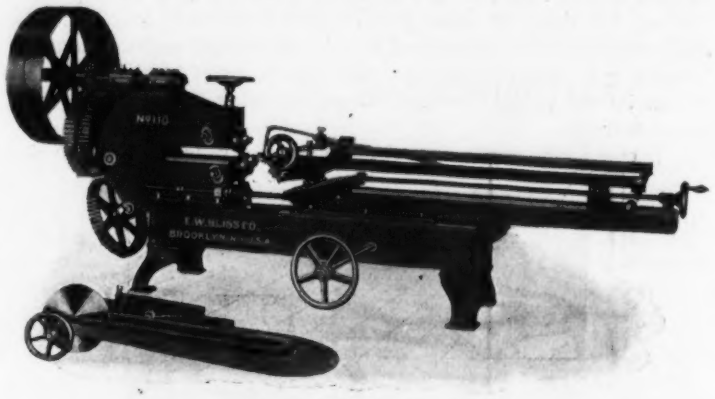


FIG. 1—CIRCLE-CUTTING SHEAR.

struction of the largest generators as for the disks of smaller diameters.

The circular or circle-cutting shear, Fig. 1, is adapted for cutting both the inside and outside of circles or rings of from 14 ins. to 72 ins. in diameter, and up to No. 10 stubs gauge in thickness. For circles of the dimensions given it is necessary to insert the plain clamping arm shown on the floor in the illustration. When segments are required, the special device in position for clamping the sheet is employed. By means of this device, segments up to the following

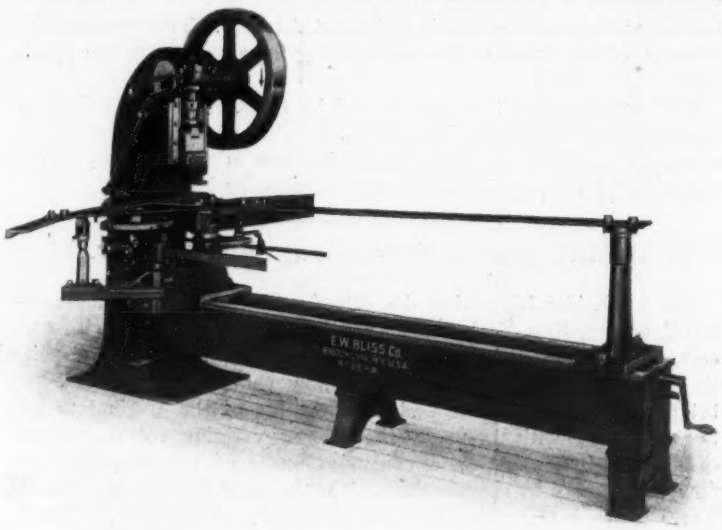


FIG. 2—NOTCHING PRESS.

dimensions may be cut: Greatest radius, 96 ins.; shortest radius, 36 ins.; greatest width of segment, 18 ins. This shear is made particularly heavy throughout, and weighs approximately 5200 lbs.

The disks, or the segments, as they come from the circular shear, are ready for notching, for which purpose the notching press, Fig. 2, was designed. As illustrated, this press is adapted for notching segments of the same radius as the shear. When the segment has

been notched, the press will automatically stop. To notch complete disks of from 4 ins. to 60 ins. in diameter, it is only necessary to remove the special holder, and place in its position the regular clamping arm (not shown) that is supplied with the press. The weight of this press is about 3900 lbs.

These two machines have recently been built by the E. W. Bliss Company, 43 Adams Street, Brooklyn, N. Y., for a large manufacturer of dynamos and motors in England.

Storage Battery Ignition Outfit.

The apparatus illustrated herewith is designed to ignite charges in gas and gasoline engines. It consists of four No. 2 cells of United States storage battery, arranged in two separate pairs; a special spark coil and a double-throw, four-point switch, all being mounted on a polished panel, 16 ins. square. The two cells in each pair are connected in series, one pair being charged while the other is at work. The change from one set to the other is effected by throwing the switch either to the right or left.

In connection with the special spark coil the two cells at work will furnish a spark for a single cylinder engine making 280 r. p. m. for upward of 100 hours on one charge, without missing an explosion. During this time the other pair of cells is being charged, and by throwing the switch the second pair is set to work and the first pair is recharged. The cells are recharged by means of a small generator driven by the engine itself, or from any other available source of direct current.

It is customary to alternate the two pairs of cells each day, so that

IGNITION OUTFIT.

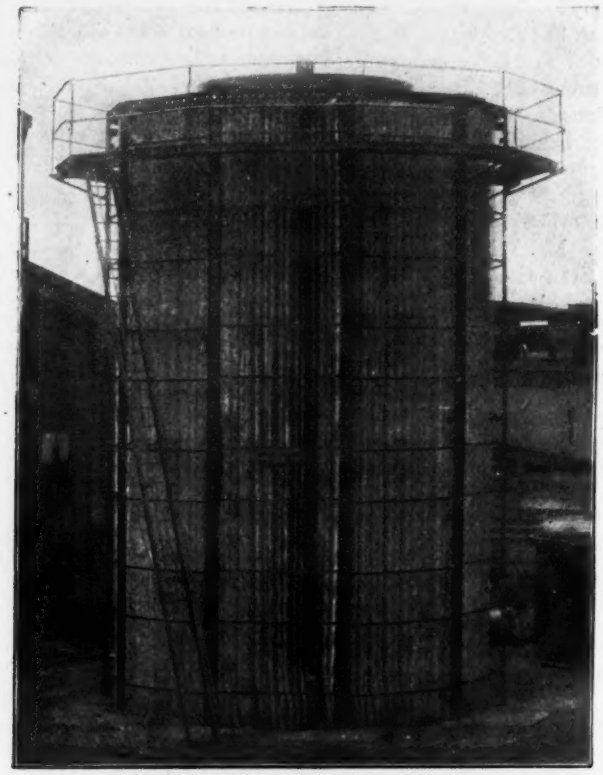
one set works one day and is recharged the next. This reverses the polarity of the current, thereby causing equal wear on the spark points.

This outfit, which is manufactured by the United States Battery Company, 253 Broadway, New York, is said to have given excellent results in practical operation, a great increase in the efficiency of the engine being the principal advantage obtained by its use.

Barnard Fanless Self-Cooling Water Tower.

For a considerable period the Wheeler Condenser and Engineering Company, New York, has been building and installing, with success, the Barnard-Wheeler cooling tower (fan type), but, despite the wide use of this device, it has now evolved a cooling tower bringing into play all the desirable features of the original tower, but dispensing with the use of the fans for creating a draught, and, consequently, eliminating a constant source of expense, viz., the power necessary to run the fans. The Barnard fanless self-cooling water tower is the result of years of study and costly experiment, the object in view having been to obtain maximum efficiency with minimum cost and space or ground area requirements. All mechanical means to circulate the air for cooling the water have been dispensed with. The water distribution system is unique in that provision has been made to operate parts of the tower where variable loads are encountered, and also that repairs and cleansing do not entail a shut-down. A gallery and ladder provide means of inspection at all times. The entire structure is braced against strains or exposure to wind pressures, insuring rigidity under all conditions. The average height is about 30 ft., and the weight per square foot of foundation area is very low, thus allowing for roof installations where ground space is not available. The increased pump duty on a roof tower when used in conjunction with a Wheeler Surface Condenser is that due to the height of the tower solely, as the uptake and down columns balance below the tower tank.

The accompanying cut shows a 1000-hp tower. The hot circulating water, when discharged from the condenser, is pumped up through a central standpipe, from which it is led to a trough and distribution pipes, which insure the constant flow of a thin film of water over the meshes of galvanized wire mats, which drain into a tank forming the foundation of the tower, and from whence the cooled water is returned for another trip to the condenser. The mats are entirely exposed to the atmosphere and are arranged in such a manner that the circulation of air is complete, and the consequent evaporation carried far enough to reduce the temperature of the



1000-HP. FANLESS COOLING TOWER.

water to a sufficiently low point for good condensing purposes, a common reduction being from, say, 135 degs. to between 85 degs. and 90 degs. In the Barnard tower this is accomplished simply by making use of natural conditions, and without the use of expensive apparatus or power.

Lightning Arrester and Distributing Board.

A new style of lightning arrester and cross-connecting distributing board is being marketed by the American Electric Fuse Company, Chicago, Ill. The distributing board is claimed to be the cheapest and most efficient ever manufactured, and has been practically tested by telephone companies. These boards are made to accommodate as many lines as desired, and are provided with carbon lightning arresters mounted on either slate or hardwood base, the latter being preferable. They afford perfect contact for the wires at every point. The method of handling the wires as they come to the distributing board is unique. The wires occupy exceedingly small space, being compactly and handily arranged for connection with the board. The mountings are all of the strongest polished brass, fitted with compact washers and distributing posts. For the better handling of the distributing wires, a lock-nut form of binding post is used, which screws the wires in place. A 50-line distributing board occupies a space of 3 ft. 2 ins. by 10 ins., with a height of 2 in. at the highest point. These distributing boards can be fitted up for special purposes wherever desired, using porcelain or the ordinary hardwood base, as required.

The company will be pleased to hear from any one interested in this subject.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—The stock market was intensely dull and uneventful all the week, and speculative activity was at its lowest ebb. In the money market, call loans were abundant, and were quoted at the close at 1¼@1½ per cent. Commercial paper was quiet, at 3½@4 per cent for thirty to ninety days, and 4@4½ per cent for longer periods. Electrical and electric railway stocks, with the single exception of General Electric, showed a little more strength and firmness, closing the week with slight net gains in price. The decision of the court in the Brooklyn 10-cent fare case caused a sharp rise of Brooklyn Rapid Transit to 60, which price, however, fell off later to 55½ on realizing, but on Friday there was another rise and the stock was carried up to 60½. This stock closed at 58¾, the net gain being 2¼ points. The number of shares sold was 192,889. General Electric fluctuated between 131 and 129, closing at the latter figure, a net loss of 1½ points. Metropolitan Street Railway made a net gain of 2¾ points, closing at 157; the sales were 15,800 shares. Western Union closed at 80, which represents a net gain ⅛ point. The market for outside securities in a measure reflected the conditions of the stock market, and was, in consequence, irregular and dull. A few net gains are recorded in the industrials, Electric Boat closing with an advance of 1 point. Telep., Tel. and Cable of America was also active at times during the week. Following are the closing quotations: Electric Boat 16, do. pfd. 30; Elec. Veh. 20, do. pfd. 40; Gen. Carriage 6¼; Ill. Elec. Veh. Trans. 1; New Eng. Elec. Trans. 4¼; New York Elec. Veh. Trans. 7; Telep., Tel. and Cable of America 4¾; Hudson River Tel. 116; N. Y. & N. J. Tel. 160. In Boston, American Telephone and Telegraph closed at 144; Erie Telephone 96; Michigan Telephone 85; New England 125; Mexican 2⅛; Gen. Elec. pfd. 138⅞. In Chicago, Central Union Telephone closed at 43.

NEW YORK METROPOLITAN.—President Vreeland says: "Traffic on the Metropolitan system is highly satisfactory. We are really doing a phenomenal business. Last year our business increased to the extent of $1,500,000 over the preceding year. We expect to do very much better when we begin to derive the benefits of the additions and improvements being made or to be made to the property. We hope to have all the lines ready for electric operation by the late fall. This will, of course, result in a greatly reduced operating expense, as the cost per car mile under cable operation is 18c., while under electric operation it is only 12½c. The saving in operation which can thus be effected on the cable lines alone will undoubtedly be sufficient to provide 7 per cent interest on the new issue of stock. While there were some imperfections in the electrical equipment of the Third Avenue track, they were not at all serious, and we have been getting rid of them since we came into control of the property. They do not involve much work and are being removed in connection with current improvements."

ELECTRIC RAILWAYS IN MEXICO.—A despatch from Cleveland, Ohio, states that a syndicate in that city has just closed a deal to operate the electric transportation systems of six of the largest business centres of the Republic of Mexico. The deal involves capital to the extent of $2,000,000, a great part of which has been pledged by Clevelanders, the remainder being contributed by leading financiers of the east and west. R. J. Hartman, of Arizona, a wealthy mine owner of Mexico, is chief promoter of the scheme. The railway properties of the cities of Pueblo, Guadalajara, Monterey, San Luis, Potosi and Aguas Calientes are involved. The property has been paying, Mr. Hartman says, but Mexicans do not seem to be able to manage American machinery properly. It is the syndicate's intention to change the horse-car systems to electric systems of the latest and most serviceable kind. The syndicate will have its headquarters in Cleveland, and the bond issues will be handled there. The deal will be financiered by a Cleveland trust company.

N. E. ELECTRIC VEHICLE.—The stock of the New England Electric Vehicle Transportation Company has recently advanced from $3 to $5 per share, but at this price the stock is selling for less than the actual amount of cash per share in the company's treasury. The New England Company is having a very satisfactory business, but pending the enlargement of its main station—the old Cyclorama building—the company has not added to its equipment. It now has about 260 vehicles in service, nearly all of which are leased by the month. It has recently leased ten of its vehicles to the Armstrong Transfer Company for use between the Union stations. Its open vehicles at Newport are all out on lease by the month and are proving very popular.

DIVIDENDS.—The Consolidated Car Heating Company has declared a semi-annual dividend of 1¼ per cent and 3½ per cent extra, payable August 15. The Westinghouse Electric and Manufacturing Company has declared a quarterly dividend of 1½ per cent, payable August. 15. The New England Telephone and Telegraph Company has declared a quarterly dividend of $1.50, payable Aug. 15. The National Carbon Company, Cleveland, has declared a regular quarterly dividend of 1¾ per cent on its preferred stock, payable Aug. 15. The Hudson River Telephone Company is paying a dividend of 1¼ per cent.

MASSACHUSETTS ELECTRIC.—At a special meeting of the stockholders of the Massachusetts Electric Companies, to be held this week, in addition to approving the purchase of the South Shore & Boston Street Railway Company, they will be asked to approve the purchase of the Lowell & Suburban on the basis two shares of preferred and one and one-half shares of common stock (selling in the market for $187.50) for each share of Lowell & Suburban stock. The Lowell & Suburban has 10,000 shares of stock, and the exchange would call for the issuance of 20,000 additional shares of Massachusetts preferred and 15,000 shares of common.

GENERAL ELECTRIC'S INCREASE OF STOCK.—On July 25 the General Electric Company filed at Albany a certificate of increase of capital stock, from $20,827,200 to $25,242,200. The amount of capital fully paid in is $20,827,200, and the whole amount of debts and liabilities does not exceed $7,200,000.

Commercial Intelligence.

THE WEEK IN TRADE.—There were no noteworthy changes in trade or speculation last week. An immense corn crop in the farther West is assured, and this assurance constituted one of the favorable features. Other crop reports from the West, and fairly satisfactory gains in railway gross earnings, also constitute hopeful features of the otherwise dull, general trade conditions. The iron and steel industry was, if possible, more depressed than at any time for the past three years. Another effort is being made among the large concerns to rescue the trade from demoralization. In other lines of trade seasonable conditions prevail, and, save the reported scarcity of railway cars in the West for the transportation of grain, there are no particularly noteworthy features in any section. Bradstreet's gives the number of business failures during the week as 183. There were 202 the week previous and 170 the same week last year. The gross receipts of fifty-one roads for the third week of July aggregated $7,276,000, a gain of 6.3 per cent over a year ago. In the copper market there was a feeling that the demand would increase and bring better prices; as a consequence, there was some activity in these stocks. Amalgamated copper sold as high as 88 and Union copper reached 3. The closing copper quotations are: 16½c. for Lake Superior ingot, 16⅜ for electrolytic, and 16¼ for casting stock.

EXPORTS OF ELECTRICAL MATERIAL.—The following were the exports of electrical material from the port of New York, for the week ended July 28: Antwerp—25 packages electrical machinery, $2,261; 64 packages electrical machinery, $5,762. Bradford—1 case electrical material, $34. British Guiana—15 packages electrical machinery, $5,300; 3 packages electrical material, $39. British West Indies—18 packages, electrical material, $351. British Australia—5 cases electric motors, $777; 11 packages electrical material, $183. Berlin—5 packages electrical machinery, $635. Brazil—15 cases electrical material, $829; 18 packages electrical machinery, $1,896; 18 cases motors and parts, $1,790. Branderburg—3 packages motor parts, $75. Cuba—50 packages electrical material, $520. Central America—5 packages electrical material, $69. China—5 packages electrical material, $129. Dutch East Indies—2 cases electrical material, $162. Dublin—71 reels electric cable, $25,685. Glasgow—72 reels electric cable, $29,039; 2 cases electric machinery, $125. Genoa—12 cases electrical material, $186. Hull—36 packages electric machinery, $2,270. Hamburg—28 packages electrical material, $6,689. Havre—192 packages electric material, $12,802; 3 cases motor machinery, $140; 3 cases electric instruments, $304; 7 cases automobile material, $400; 1 package automobile, $100; 5 cases electric machinery, $233; 7 packages electric motors, $74. Hong Kong—17 packages electrical material, $660. Japan—68 cases electrical material, $1,625; 30 cases electric machinery, $2,970. Liverpool—50 packages electric machinery $10,712; 1 package electrical material, $901; 29 packages motors, $1,160. London—48 packages electrical machinery, $6,129; 117 packages electrical material, $8,291; 63 reels electric cable, $13,932; 3 motors, $490. Leith—2 cases electrical material, $421. Mexico—49 packages electrical material, $1,352. Manchester—55 packages motors, $2,500; 7 cases electrical material, $541. Mariopol—37 cases electric machinery, $5,815; 61 packages electrical material, $1,858. Naples—39 cases electrical ma-

terial, $7,899. Newcastle—28 packages motor machinery, $4,600. Peru—10 cases electrical material, $496. Riga—13 cases electrical material, $1,204. St. Petersburg—49 packages electrical material, $3,215; 32 packages electric machinery, $3,200. Southampton—133 packages electrical machinery, $1,380; 32 packages electrical material, $1,312. Siam—18 packages electrical material, $705. United States Columbia—100 packages electric machinery, $3,450. Vladivostock—11 boxes electric machinery, $3,240. Zurich—2 packages electrical material, $100.

CONDITIONS AT BARCELONA.—The following has been received from Consul-General Lay, of Barcelona: I give below the names of the directors and chief contractors of a tramway line about to be built between Barcelona and Horta, a distance of four miles. The name of the branch line will be the Bercelona & San Andres Railway, work to be commenced in June. Builders, Société Anonyme d'Entreprise Générale de Travaux at Liege, Belgium. President, Mr. Laloux. Director-general, Mr. Thouet. The chief contractor is F. H. Bagge, 14 Ronda Universidad, Barcelona, who imports his trucks, tubing for posts, and motors from the United States. The wire is to be supplied from Germany; rails, from Belgium; car motors, by General Electric Company, Paris; gas engines, Crossley, of Manchester; cars from Saragossa, Spain; accumulators, Tudor; dynamos, Industrial Electrico, Barcelona. I find it very difficult to get any reliable information about projected roads, especially about those for which the equipment is being bought, as the directors, chief engineers and other officials of new tramways are foreigners and have their headquarters in other cities. I would suggest, therefore, that our manufacturers write the Société Anonyme d'Entreprise Générale de Travaux, Liege, Belgium, in good time before the contracts are let at Brussels. The society is a very large one, and has built many miles of tramways in Europe, and is constructing lines in Russia, I understand, at the present time. In connection with the sale of electrical supplies and equipment in Barcelona, I would advise manufacturers of motors not used in connection with tramways and other small electrical appliances that their agents here must keep a certain stock of such articles on hand, as I am informed by several electrical importers of Barcelona that frequently English or German goods are sold because the purchaser cannot wait for better American-made articles, which take so long to come from the United States.

THE GENERAL ELECTRIC COMPANY will undertake the contract for the supply of the equipment for the main power station for the Sydney Tramways. The contract price, for both the electrical and steam plants, is said to exceed $800,000. As stated in the interview with Charles Oliver, the chief railroad and tramway commissioner of the New South Wales government systems, which appeared in our last week's issue, the electrical part of the contract will consist of three 1500-kw generators. There will be the same number of engines, having a nominal capacity of 1500 horse-power. These engines will be built by the Edward P. Allis Company of Milwaukee. The requisite piping, fittings and so forth will be manufactured by the Crane Company of Chicago. In addition, the new plant is to be equipped with the G. E. generators and Allis engines which were shipped some months ago for installation in the existing power house of the Sydney Tramways. The projected generating station is intended to develop 6800 horse-power and will, it is believed, be one of the most perfectly equipped plants in the world. Mr. Oliver, who sailed last Saturday for Europe, said, on the eve of his departure, that a decision had not yet been arrived at as to whether structural steel would be used in the construction of the power station, but that something definite would be settled on that point within the next few weeks.

THE BLISS-CHESTER COMPANY has just been established in Providence, R. I., and announces that it will manufacture a line of metal novelties, sheet metal stampings, etc., and will make a specialty of incandescent lamp caps. It is thoroughly equipped to make all kinds of cupped work, caps, steel metal stampings and screw machine products, and each department of the factory will be equipped with up-to-date machinery. The firm is composed of Mr. Milford E. Bliss and John Chester. Mr. Bliss has for the past nine years been connected with the Mossberg Manufacturing Company, Attleboro, Mass., and later with the Mossberg & Granville Manufacturing Company, Providence, R. I. Mr. Chester was for some years with the Waterbury Brass Company, and afterwards superintendent of the Providence Gas Burner Company, and has had a large experience in manufacturing cupped and sheet metal goods. He will superintend the manufacture of the new company's products.

CROCKER-WHEELER COMPANY has received an order from the Frick Company, Waynesboro, Pa., for a 400-kw generator, 250 volts and a compound generator, belt type, with switchboard, constituting quite a large and important plant. It has also received from the Philadelphia Engineering works a number of orders for crane motors. These motors will be 30 horse-power, standard iron-clad mill type; 18 horse-power standard iron-clad mill type, 15 horse-power and 7 horse-power. The company has also secured an order that was very much in competition, namely, that for the electrical equipment of the new shops of the Chicago, Burlington & Quincy Railroad at Hannibal, Mo. The contract comprises 55 motors of various sizes from 1 horse-power up to 50 horse-power, and aggregates not less than 440 horse-power. Many of these machines will be of the company's new semi-enclosed form, sizes 3, 5 and 7½, and there will be several 25-hp and 35-hp enclosed motors.

THE AMERICAN ENGINE COMPANY of Bound Brook, N. J., reports that its business is steadily increasing; that, although it is running its establishment night and day, it is now six months behind its orders. A large addition to its works is now in progress, which will increase its facilities greatly. Most of its new business in the engine line is in connection with the duplex compound engine. Among recent orders for this new engine are the following: United Gas Improvement Company of Philadelphia, American Steel and Wire Company, Hibbard-Rodman-Ely Safe Company, Alabama Electric Light and Power Company, Pepper & Register, Northern Central Railway Company, Charles Ward Hall and others. The company also reports a large business in its electrical machinery, both in direct-connected generators and in belted machines.

BULLOCK EQUIPMENT IN EUROPE.—Shipments have commenced on the $500,000 contract made by the Bullock Electric Manufacturing Company with a French syndicate for the electric equipment for street railways in different parts of Europe. Street railway generators of 800-kw capacity were consigned recently to Alexandria, Egypt, and a 400-kw generator to Algiers. A company in Lyons, France, is also getting a large generator. The Bullock Company has also shipped considerable of the apparatus for the Russian-Chinese railroad—five car-loads—and is doing a large lot of work for the United States Government in the Philippines, in supplying 30 generators for United States transports. A large printing press equipment goes to St. Petersburg, Russia.

MATERIAL NEEDED.—The Electric Light and Power Company of South Boston, Va., James A. Mebane, electrical engineer, is ready to contract for its dynamo capacity up to about 500 kilowatts. They also want about 600 horse-power in water wheels, etc., and wish to receive proposals. The Avenue Hotel, Hot Springs, Ark., is in the market for a complete electric-light plant, comprising engine, dynamo, switchboard, boilers, etc., with sectional switches, branch blocks, etc., for 600 to 1000 lights, and including wire. The hotel prefers new apparatus, but will consider second-hand if in good order.

PROPOSALS will be received at the Architect's office, U. S. Capitol, Washington, until Aug. 11, for furnishing and installing a steam boiler, engines and generators for use in the old library space in the Capitol, as follows: One forged steel water-tube boiler of 250 horse-power, of the high-pressure type now in use in the Capitol; and for two 187½-kw Westinghouse generators direct connected to suitable Westinghouse compound engines with marble power panel, connection, instruments, etc., all to be similar in character and type to those now in use, and to operate in conjunction with the present plant. Address Elliott Woods, Acting Architect, U. S. Capitol.

ELECTRIC RAILWAYS IN BRAZIL.—The Brazilian government recently granted a concession for an electric railway in Santos to Drs. Santos da Silva and Joao da Silva Martins. This concession has been secured by the San Paulo Tramway, Light and Power Company, and work on the road will be undertaken as soon as the material can be obtained. Bids are now being asked for material and equipment. Mr. F. S. Pearson, 621 Broadway, New York, is chief engineer of the road and makes all of the purchases.

BABCOCK & WILCOX BOILERS have been in such growing demand in England that the London company has found it imperative to remove to larger quarters. The scarcity of available offices near the company's former location on Queen Victoria Street made the move necessary, as the draughting room facilities had to be increased. Commodious offices have been secured at Oriel House, Farringdon Street, the whole building having been taken.

JOHN A. MEAD MANUFACTURING COMPANY, 11 Greenwich Street, New York, have the contract for the coal and ash handling machinery in the power-house of the Manhattan Elevated Company, also for the new Harrison Street station of the Chicago Edison Company, and the power-house of the Chicago Northwestern Elevated Railroad Company. The New York apparatus will comprise four conveyer systems and one steam shovel.

MARINE APPARATUS.—It has recently been decreed that apparatus and materials for electric-light plants on sea-going ships, including searchlights and their appurtenances, shall be hereafter admitted into the German Customs Union free of duty.

LAMPS FOR SOUTH AMERICA.—The Western Electric Company has received a very large order for the new type Sunbeam incandescent lamp for shipment to South America. It reports largely increasing sales for these lamps.

CONSOLIDATION OF MACHINERY INTERESTS.—Plans have been practically completed for the amalgamation of the Pratt-Whitney Co., of Hartford, Conn., with the Niles-Bement-Pond Co.

General News.

THE TELEPHONE.

CHARLOTTE, N. C.—The Smithfield Telephone Company, Smithfield, N. C., has sold out to the Home Telephone Company.

LIMA, OHIO.—The Lima Telephone Company is placing its wires underground in the central portion of the city.

MEMPHIS, TENN.—A meeting of the independent telephone people of Mississippi will be held at Aberdeen, Miss., about Aug. 15.

PORTSMOUTH, OHIO.—The Home Telephone Company is building a tower for the purpose of stringing its wires across the Ohio River.

FOSTORIA, OHIO.—The Citizens' Telephone & Message Company, which was recently reorganized, is preparing to thoroughly rebuild its system.

HUBBARD, OHIO.—The Central District Printing & Telegraph Company, of Pittsburg, is at work securing subscribers for a prospective exchange in this place.

CLEVELAND, OHIO.—The officials of the Findlay Home Telephone Company, recently organized, have decided to commence the work of construction at once.

RAVENNA, OHIO.—The Home Telephone Company, of Ravenna, is meeting with such success in extending its system that additional switchboard capacity will be required.

NINETY-SIX, S. C.—The Ninety-Six Telephone Company has been commissioned. Capital stock to be $500. E. M. Lipscomb, A. S. Osborne and R. R. Calhoun are the corporators.

RIDGEVILLE, IND.—A company has been organized and sufficient stock subscribed for a telephone exchange at this place. The company will start with fifty business and residence patrons.

CIRCLEVILLE, OHIO.—The Citizens' Telephone Company has been granted a franchise in this city. The People's Telephone Company, another independent company, was defeated in its attempt to secure a franchise.

STURGEON, MO.—The New Century Telephone Company, of Sturgeon, Mo., capital stock $10,000, has asked for letters of incorporation. The incorporators are O. D. Gray, T. R. Monis, William Seymour, S. P. Hulen and T. D. Sayre.

AKRON, OHIO.—The city police and fire departments have arranged to operate their new systems through the conduits of the Central Union Telephone Company. The Standard Underground Cable Company has the contract for the cables.

STEVENS POINT, WIS.—The Wisconsin River Telephone Company has been incorporated with a capital of $25,000. The incorporators are F. L. Dillie and John Relin, Stevens Point, and A. L. Hutchinson, Weyanwega. The company will operate in connection with the Wolf River toll line.

ST. LOUIS, MO.—The City Counselor has notified the Kinloch Telephone Company that unless the company files statements of its earnings and pays 5 per cent thereon to the city, its license to occupy the streets with conduits will be revoked. The Kinloch Company claims that it pays all its taxes.

LONDON, OHIO.—The London Telephone Company, operating throughout Madison County, elected the following officers: William M. Jones, president; R. W. Boyd, treasurer; F. W. Pierce, secretary and general manager; directors, Ed. L. Barber, William M. Jones, R. W. Boyd, J. L. Haner and A. S. Bell.

COLUMBUS, OHIO.—The Columbus Druggists' Association has decided not to favor either of the competing local telephone systems, but it has made the demand that pay stations shall be placed in all drug stores, with no charge to be made for emergency cases, such as fire, police, ambulance, or physicians' calls.

LOGANSPORT, IND.—The Indianapolis Independent Telephone Company has been granted a franchise by the Logansport City Council for the use of the streets in establishing four toll stations. The company is required to give $15,000 bond. The Central Union Company presented an ordinance asking a renewal franchise for fifty years with no restrictions as to rates.

MILLERSBURG, OHIO.—The Killbuck Telephone Company has defeated this village in an attempt to restrain it from installing a local system. Judge Easton, before whom the case was tried, held that there was no ordinance against the construction of the company's project, and that as the wires are to be 35 ft. from the ground, there will be no interference with the use of the streets.

LIGONIER, IND.—The telephone plant has changed ownership and the plant will be remodeled and the Albion exchange made a full metallic system. The new owners are stretching wires on the Wolf Lake-Kimmel line and the same will be extended to Cromwell and thence to this city. Exchanges will be placed in several of the smaller towns on the line. Messrs. Spencer and Ackerman are now in control.

INDIANAPOLIS, IND.—Secretary Gates of the New Telephone Company, appeared before the State Board of Tax Commissioners last week and submitted the following statement: Capital stock, $400,000; divided into 3,560 shares. It has 1,430 residence and 1,399 business telephones. Its gross earnings from the time it began business—July 1, 1899, to April 1, 1900, was $59,152.96. The net earnings were not given. The statement also showed value of stock to be $356,000; mortgages, $500,000; real estate, $24,550. There are also $800,000 mortgage bonds in the hands of the trustees.

CHICAGO, ILL.—The new trunk exchange operating room just opened by the Chicago Telephone Company, has been put into service and 14,342 lines connected with the main office, transferred from the present board at 203 Washington Street to the new terminal room in the lately completed addition to the building. The old room has been in use since 1888, and since that year over 10,000 instruments have been added to the system. The new board is similar to the one now in use at the Harrison, Monroe and Central district stations, the most important change being the electric-light signal for calls, in place of drop numbers. Of the telephones now operated in the downtown branch over 9,700 are in the district which was covered by the main office previous to the establishment of the Central and Monroe exchanges. The new book, which shows all changes in numbers, now contains 30,000 names.

BOSTON, MASS.—Construction work by the Massachusetts Telephone and Telegraph Company is being vigorously pushed. Conduits are now being laid on Congress Street into State Street. President Holbrook says that the business section of the city will be connected by an independent telephone service before snow flies. The company has ordered a switchboard to be delivered within sixty days at its central office on Franklin Street. Orders have also been placed for the first installment of 500 telephone instruments deliverable within ninety days. The Massachusetts Telephone and Telegraph Company has now been in existence about two years, during which time it has expended about $250,000 in construction and an equal amount for real estate. Officials of the Erie Telephone Company will occupy the present offices of the Massachusetts Telephone and Telegraph Company on Aug. 1, and the latter company will remove to new offices in its central building on Franklin Street.

BROOKLYN, N. Y.—The transferring of the wires, switchboard and office paraphernalia of the Borough of Brooklyn police telegraph system was completed on July 25, without a break in any of the wires or a lost call. This was a remarkable piece of engineering when taken in consideration the fact that the old switchboard was transferred in sections from former headquarters in the Municipal Building to the building formerly occupied by the N. Y. & N. J. Telephone Company at 16 Smith Street, the old operating room of the latter company now being used as the operating room for the police telegraph; the side walls being black walnut and so arranged as to kill as far as possible all acoustic properties. As arranged, it is probaby the most complete police telegraph operating room in the world. The entire system embraces 560 miles of wire, mostly underground or on the elevated railroad in cables, 469 police signal boxes and 500 telephones. Mr. Frank C. Mason is the well-known superintendent and Mr. T. Williams, chief operator.

ELECTRIC LIGHT AND POWER.

SYRACUSE, IND.—The town board of Syracuse has contracted for an electric light plant to cost $26,000.

BRILLION, WIS.—The new electric light plant at Brillion has been completed and the city is now lighted by electricity.

LANSING, MICH.—The Washtenaw Electric Company has been organized in Geddes, Mich., with a capital stock of $50,000.

PORT GIBSON, MISS.—Contract has been let for two new machines for the electric light plant to the General Electric Company.

AIKEN, S. C.—The Carolina Light & Power Company, of Aiken, has given notice of an increase of capital stock from $20,000 to $50,000.

CHARLESTON, S. C.—The city may adopt plans looking to the municipal ownership of a lighting plant in connection with a water-works system.

MT. STERLING, KY.—The Mt. Sterling Water Works Company has purchased the electric light plant of J. M. Pickrell, paying therefor $28,000.

EAST ORANGE, N. J.—The East Orange City Council has decided to have an ordinance prepared providing for placing all electric wires underground.

REDKEY, IND.—The town trustees have secured plans, estimates, etc., for the erection of an electric light plant, the work of construction to begin Aug. 1.

BEEVILLE, TEX.—The Beeville Light Company, of Beeville, has been chartered. Incorporators: P. H. Swearingen, Benjamin Dubinski and S. J. Brooks.

RADFORD, VA.—The Radford Electric Light & Power Company and the Radford Electric Railway Company have been consolidated under one management.

ALLIANCE, OHIO.—The City Council passed a resolution for the erection of an electric light plant for public and private lighting. The plant will cost about $40,000.

SAN FRANCISCO, CAL.—The Pacific Power Company's building and electric power plant, San Francisco, were recently damaged by fire to the extent of about $20,000.

WABASH, IND.—The electric light plant and the water works of Wabash have passed to the control of the representatives of the First National Bank, of New York City.

MORRICE, MICH.—Fire destroyed the electric light plant here recently. The plant was purchased by Sutton & Mackey only a few weeks ago, and was valued at $10,000.

CHICAGO, ILL.—The Economic Light & Power Company, of Chicago, has been incorporated. Capital, $10,000. Incorporators: E. C. Wetlen, D. T. Campbell, L. Spahn, all of Chicago.

LANCASTER, S. C.—The Lancaster Cotton Mills will erect a huge mill, four times the size of the present plant, which will be run by electricity generated at Landsford, on the Catawba River.

MEMPHIS, TENN.—The Fransioli Hotel is being enlarged to double its present capacity. A new dynamo will be required, and the entire house rewired for lights, annunciators, etc.

FORT WORTH, TEX.—The Standard Light & Power Company property, which includes a franchise, engines, dynamo, etc., was advertised for sale, but there were no bidders for the property.

MADISON, WIS.—On July 13 the electric lighting plant at Mazomanie was struck by lightning and completely destroyed. The village owned the plant, which was recently built at a cost of about $35,000.

MEMPHIS, TENN.—Capt. A. E. Drinkwater, of this city, has secured a contract to put a water and electric-light plant in at Forest City, Ark. He would like bids on dynamos, etc., for 1500 to 2000 16-cp lights.

CARO, MICH.—A new lighting company has been organized here under the title of the Mutual Incandescent Lighting Company. It is capitalized at $10,000. W. J. Gamble is the secretary of the company.

ST. LOUIS, MO.—The Board of Public Improvements has been asked to forward an ordinance to the Municipal Assembly for the construction of a city lighting plant, to supply light to the waterworks service stations.

WOONSOCKET, R. I.—The electric light contract of the city with the Woonsocket Electric Machine & Power Company has been renewed for three years, at the present price, 40 cents per light per night for a 2000-cp arc light.

TRENTON, N. J.—The Willington Street Lighting Company, of Jersey City, has been incorporated. Capital, $250,000. Incorporators: George R. Webb, John William Middendorf, Harry W. Webb, William H. Martin.

MILWAUKEE, WIS.—The South Milwaukee city council has voted to purchase the electric-light equipment of the South Milwaukee Electric Light Company for $27,000. The city is now paying $245 a month for 35 arc lights.

KENTON, OHIO.—The Village Council is desirous of securing electric street illumination. It wants a plant to furnish 110 arc lights of 2000 candlepower, and will give a five-year contract and franchise to a new company.

MEMPHIS, TENN.—Work will commence on the new Gayoso Hotel about Sept. 1. This hotel will have 500 rooms, will put in an electric lighting plant and a modern telephone system. Mr. Bell, of Chicago, Ill., is the architect.

ALBANY, N. Y.—The Croton Electric Light & Power Company, of Cortland, has been incorporated. Capital, $10,000. Incorporators: J. R. Swain, of Sing Sing; R. P. Barry, Jr., J. M. Mitchell, both of New York City; H. M. Haviland, of Brooklyn.

KALAMAZOO, MICH.—The Kalamazoo Valley Power Company, with circuits running 45 miles from Allegan, is likely to be of service to farmers along the route by furnishing them with cheap power for all kinds of rural and agricultural work.

SALT LAKE CITY, UTAH.—A receiver has been appointed for the Salt Lake City Water & Electric Power Company. Capital, $1,000,000. Liabilities, $400,000. It is expected the company will reorganize. President Tarbet is creditor for $300,000.

RED BLUFF, CAL.—The Red Bluff Electric Light & Power Company was recently incorporated. Directors: Henry A. Gesford, R. S. Masson, H. C. Donnels, P. S. Coke, W. J. Priest, W. F. Wallace and A. R. Kanago. The capital stock is $125,000.

ALBION, N. Y.—At the annual meeting of the Albion Electric Power Company recently the following directors were elected: Wallace Johnson and Frank Dudley, Niagara Falls; P. R. Tyng, Buffalo; George Lum, Waterport; Sanford T. Church, Albion.

NORFOLK, VA.—The Norfolk Heat, Light & Power Company, controlled by Philadelphia capitalists, has decided to issue $500,000 in bonds. The property will be mortgaged to secure the Central Trust Company, of Philadelphia, which will underwrite the issue.

ATHENS, OHIO.—The Village Council has passed an ordinance requiring the local lighting company to furnish incandescent lights for the streets. Three years will be added to the company's franchise in consideration of the expense incurred in changing the system.

MONTPELIER, VT.—The Chittenden Power Company, of Rutland, has been incorporated. Capital, $50,000. Incorporators: H. C. Hoag, H. O. Carpenter, both of Rutland; G. H. Davis, F. D. Proctor, F. C. Partridge, all of Proctor; F. C. Partridge, attorney, Proctor.

NEWTON FALLS, OHIO.—Mr. E. B. Craft, an electrical contractor from Warren, Ohio, is planning to organize a local company for the purpose of erecting a plant to furnish light for residences and street lighting. He has furnished estimates to the town officials.

RICHMOND, IND.—City Attorney Jessup has been instructed by the Richmond council to draw up a bill to be presented to the Legislature, which will give the City Council all the power to transfer the control of municipal light plants to non-partisan boards of citizens.

BALTIMORE, MD.—Messrs. Lites, Berwanger & Company, the Baltimore clothiers, are installing a large isolated electric light plant. Henry E. Adams has been engaged as the consulting engineer, and the contract for the plant has been awarded to Kingsbury, Samuels & Company.

NEW YORK, N. Y.—The Seaside Electric Light, Heat & Power Company, of the Borough of Queens, New York City, has been incorporated. Capital, $5,000, and directors: William Wainwright, Mrs. Sarah Tator, John Remsen, William G. Wainwright, John W. Wainwright, of New York City.

TOLEDO, OHIO.—The trustees of the Northwestern Ohio Insane Asylum have decided to install an electric lighting plant for the institution, and Prof. Thompson, of the Ohio University, has been engaged to prepare plans and specifications. It is estimated that the plant will cost $10,000.

SAN FRANCISCO, CAL.—The Fort Miller Power Company has been incorporated with San Francisco as the principal place of business. The directors are: W. Saunders, A. J. Morganstein, T. O. Carter, K. D. McCann, San Francisco, and F. G. Berry, Fresno. Capital stock, $1,000,000, all subscribed.

DAYTON, KY.—The Wadsworth Watch Case Company, Dayton, Ky., is installing a large storage battery plant. The concern will make not only its own electric light, but will fill the contract for lighting the town of Dayton. D. J. Hauss, a Cincinnati electrical contractor, has the matter in hand.

ELKHART, IND.—The new owners of the Home Electric Light & Power Company have elected the following officers: President, H. L. Crawford, of New York; vice-president, P. F. Thompson, of New York; secretary, James Du Shane, of South Bend; treasurer and general manager, A. M. Barron, of this city.

SAN FRANCISCO, CAL.—The Mt. Lassen Power Company has been incorporated, with headquarters in San Francisco. Directors: A. Hochheimer, of Willows; C. L. Morrill, F. Smith, A. F. Johns, of San Francisco; R. M. Saeltzer, H. L. Shannon, of Redding, and Park Henshaw, of Chico. Capital stock, $1,000,000.

ALBANY, N. Y.—Certificates of merger of the Electric Illuminating and Power Company of Long Island City, the New York and Queens Gas and Electric Company, and the Jamaica Electric Light Company with the New York and Queens Electric Light and Power Company, have been filed with the Secretary of State.

ST. LAWRENCE COUNTY, N. Y.—The St. Lawrence Gas, Electric & Transportation Company has been incorporated at Trenton, N. J., with authorized capital of $400,000, common stock. The new company is a consolidation of the gas, electric light and trolley companies of St. Lawrence County, this State, and it is understood is controlled by the Widener-Elkins syndicate.

RICHMOND, VA.—The Richmond Locomotive & Machinery Works has closed a contract with the Virginia Electrical Railway & Development Company, by which the locomotive plant will be operated and lighted by electricity. New machinery will be installed at a cost of from $20,000 to $30,000, and the replacing of steam power by electric power will be done gradually.

BALTIMORE, MD.—The Towson Water Company has sold to the Baltimore County Water & Electric Company, for $21,000, all its real estate, plant, franchises, water mains, etc., located at Towson. The plant will be used in connection with the plants of the Catonsville Water Company and the Chesapeake Water and Electric companies, which have been consolidated under one management.

ANN ARBOR, MICH.—The Washtenaw Electric Company has been incorporated. Capital stock, $50,000. The offices are to be at Ann Arbor and Ypsilanti and the power plant at Geddes. The incorporators are: Bernard Rorison, A. C. Rorison, W. J. Clarke, P. M. Miller, W. H. Sweet, C. L. Stevens, Robert Hemphill, Jr., A. Beyer, R. W. Hemphill, Clark Cornwell, H. P. Glover and R. W. Hemphill, Jr., trustee.

OTTAWA, ONT.—At the annual meeting of the Royal Electric Company, of Montreal, the contract with the Chambly Electric Company, of that city, was ratified. It provides that the Royal Electric Company shall purchase all of the power developed by the Chambly Company for a period of 50 years, at the rate of $15 per horse-power per annum for the first 15,350 horse-power, and $10 for any amount in excess of this figure.

MONTREAL, QUE.—The annual meeting of the Chambly Manufacturing Company ratified the contract with the Montreal Electric Street Railway Company, already agreed to by the company. By this contract the Chambly Water & Power Company undertakes to provide the Street Railway Company with electric power for a period extending over 23 years, with the option of a five years' renewal, at $25 per horse-power per year, or about $125,000 per annum.

CINCINNATI, O.—The trouble between the Board of Public Service of Cincinnati and the Edison Electric Light Company shows no signs of abatement. It is a contention on the part of the electrical people that their contract with the city, permitting certain privileges, is valid, and the opposition, on the other hand, that it is not so. A rumor suggests as the last development a crusade against overhead wires of all sorts—telegraphic, telephonic, trolley and commercial. In the meantime, the Edison people are going ahead with their conduit work, and the end is not yet.

THE ELECTRIC RAILWAY.

ASHEVILLE, N. C.—Zeb Weaver has asked for a franchise for himself and others to erect an electric railway line from Asheville to Weaverville, N. C.

EAST ST. LOUIS, ILL.—The Venice, Granite City & East St. Louis Electric Railway Company will be extended. The line will run direct from Granite City to East St. Louis.

ASHEVILLE, N. C.—The Board of Aldermen, of Asheville, has passed an ordinance granting a franchise to the Asheville Street Railway Company to lay a considerable double track in the town.

LA PORTE, IND.—The City Council recently granted a 50-year franchise to the La Porte & Michigan City Electric Railroad Company. A Chicago trust company will finance the road to the amount of $250,000.

SOUTH BEND, IND.—The Indiana Interurban Electric Railway Company is preparing to extend its line from this city to Buchanan, 16 miles, and has applied for rights of way and franchises in the towns through which it will pass.

OMAHA, NEB.—C. W. Wattles, of this city, has secured a controlling interest in the suburban electric motor line, which runs between Omaha and Council Bluffs. It is thought that the Omaha Street Railway Company is behind the deal.

INDIANAPOLIS, IND.—The Indianapolis, Morristown & Rushville Traction Company has obtained a private right of way over the whole route, and will construct an electric interurban line between Indianapolis and Rushville, a distance of 35 miles.

ASHEVILLE, N. C.—The interests of E. R. Bliss and other Chicagoans in the Intermontane Railroad Company (electric), of Asheville, N. C., have been purchased in behalf of the Asheville Electric Company. The new owner expects to make extensive improvements.

MILWAUKEE, WIS.—Certain aldermen are endeavoring to force the Milwaukee Electric Light & Railway Company to use grooved rails instead of the T rail. The company is fighting this measure, as it claims that in this territory the grooved rail is impracticable.

INDIANAPOLIS, IND.—New power-generating machinery is being added to the Indianapolis street railway plant. A 375-kw generator has just been set in place, and a 1200-kw machine is being installed. These will double the present power of the plant, which is much needed.

TERRE HAUTE, IND.—W. P. Igams, of this city, and a number of Boston capitalists have secured franchises on five roads leading out of this city for electric railway rights of way. The company has a capital stock of $800,000, and work will begin on the lines in a few months.

ANDERSON, IND.—The first train of the Union Traction Company was run

over the company's extension from Anderson to Chesterfield on July 19. The service will continue until September, when the road to Indianapolis and Muncie will be completed and through trains run to both cities.

INDIANAPOLIS, IND.—The Railway Equipment and Finance Company of this city, has been incorporated with a capital stock of $50,000. The company will promote, construct, equip and finance electric and other railroads, public works and private enterprises. The incorporators and directors are: John C. Shoemaker, Henry E. Frazier, J. McGelligan, W. E. Carter, D. A. Garwood, H. R. Culbertson and W. B. Burford.

ALBANY, N. Y.—The stockholders of the Albany & Schoharie Electric Railroad Company voted to reduce the number of directors from thirteen to nine. The following directors were elected: Henry W. Burgett, Brookline, Mass.; Charles E. Bibber, Malden, Mass.; William H. Erwin, Albany; J. Sheldon Frost, Albany; Robert J. McCauley, Albany; Benjamin M. Secor, Albany; Ezra Twitchell, Schoharie, N. Y.; Luther C. Warner, Albany; Thomas J. Wood, Berne, N. Y.

THE AUTOMOBILE.

A SIGN OF THE TIMES.—A sign in a suburban New Jersey town reads: "Automobile Machinist." This is coupled, however, with the rather ambiguous announcement, "Established 1891." The automobile industry is not quite so old as that.

AUTOMOBILE CLUB.—A number of owners of automobiles in Westchester County, New York, and Connecticut, are organizing an automobile club. It is stated that the new organization will not in any way antagonize the New York Automobile Club, and will be a separate and distinct organization. One of its principal objects will be to establish supply stations along the Albany post road, Boston post road, and other cross-country roads leading to various club-houses. At these stations, gasoline and naphtha and other supplies will be kept, and arrangements will also be made for charging electric vehicles. Among those who are backing the club are G. Thébaud, Howard Willets, Trenor L. Park, Oliver Harriman, Jr., Eugene Reynal, Nathaniel Reynal, William K. Vanderbilt, Jr., William E. Iselin and William Rockefeller, Jr.

NEW INDUSTRIAL COMPANIES.

THE ERNES-HOPKINS Company has been formed at Columbus, Ohio, for manufacturing electrical supplies. Capital, $10,000. Incorporators: J. A. Ernes, W. A. Hopkins, Jr., F. R. Huntington, T. M. Livesay.

THE AMERICAN UNIVERSAL UNDERGROUND ELECTRIC RAILWAY COMPANY, has been incorporated in New Jersey, with headquarters in Camden. Capital, $200,000; incorporators: W. Bartram, J. M. Deal, W. C. Alexander, C. P. Ballinger.

THE HYDRA DOUBLE BATTERY COMPANY of New York City, has been incorporated to do a general dry battery business. Capital, $200,000. Incorporators: B. S. Heller, N. D. Stern, F. Jelleuik, all of New York City; A. Schutzinger, of Brooklyn; H. S. Weed, of New Canaan, Conn.; F. Jelleuik, attorney, New York City.

PERSONAL.

MR. G. G. LUTHY, of the Royal Electric Company, Peoria, Ill., was in Chicago last week. He reports that the demand for Royal alternators is constantly increasing.

MR. LUTHER STIERINGER, consulting electrical engineer of the Pan-American Exposition, has been seriously ill at Buffalo with pleurisy, brought on by overwork, but is now reported to be recovering.

MR. R. W. POPE, secretary of the American Institute of Electrical Engineers, sailed for Europe this week, to attend the joint meeting in Paris of the American and English institutions, and to make the preliminary arrangements in London and Paris.

MR. C. E. WOODS has resigned as general manager of the Woods Motor Vehicle Company and has also withdrawn as a director in the concern. He has been succeeded by Mr. S. J. Moore. This action of Mr. Woods has been rumored for some time past, but strenuously denied by officials of the concern.

MR. A. A. KNUDSON has filed with the Commissioner of Public Works, of Providence, a detailed report on the condition of the water pipes and the changes that would be desirable to be made by the Union Railroad Company to minimize electrolysis. It is said alterations will be made as soon as the specifications are prepared.

PROF. G. F. SEVER, superintendent of electrical exhibits at the Buffalo Pan-American Exposition, has been in New York and Eastern cities on duties connected with this work, which he has taken up with great thoroughness and promise of success. Any one desiring to exhibit should communicate with him at Buffalo.

MR. FRANK B. RAE, the well-known electrical and mechanical engineer, has been compelled, by the requirements of work in hand in New York, to move to this city from Chicago, and has opened an office at Aldrich Court, 45 Broadway. He is making a specialty of railway and lighting work and power transmission, and the preparation of plans, estimates, evaluations, etc.

CAPTAIN CARL F. HARTMAN, of Newark, N. J., who organized a signal corps made up of Jersey City and Newark men when the Spanish war broke out and who did good work in Cuba, will go to China to help establish a signal corps over there. General A. W. Greely, chief signal officer, has provided materials and instruments for 150 miles of field telegraph.

MR. JOSEPH F. NEAVE, vice-president of the Bullock Electric Manufacturing Company, Cincinnati, O., sailed on the Majestic this week for Europe. Mr. Neave will confer with the heads of the two principal European offices of the company, at London and Paris, and will spend some time at the Paris Exposition, where the Bullock Company is said to be the largest exhibitor of electric equipments. He will return in September.

MR. C. T. YERKES, of Chicago, is now in London to attempt to consolidate the city's rapidly developing underground railways into a great electric system. Mr. Yerkes says: "I came to London simply on the invitation of capitalists here who own the charter of the underground railway. They wished to consult me. While it is not likely that I shall invest anything in their interest, I have not come here with any plan to revolutionize the transportation system of the city. I do not come at the head of any syndicate nor with any project. I am past that stage of my career."

MR. FRANK MOORE JEFFERY, for many years the treasurer of the Crocker-Wheeler Company, has opened an office in the Havemeyer Building, New York, where he will deal in investment securities and will negotiate loans and act as financial agent for corporations. Mr. Jeffery was one of the charter members of the Crocker-Wheeler Company, and in starting in business for himself leaves behind him a long record of faithful services, and one which causes the company to regret losing him. Mr. Willis L. Brownell, formerly of the Sterling-Meaker Company, succeeds him as treasurer of the Crocker-Wheeler Company.

EDUCATIONAL.

UNIVERSITY OF PENNSYLVANIA gives information regarding the courses in mechanical and electrical engineering in circulars H and I, recently issued for 1900 and 1901.

THE UNIVERSITY OF WISCONSIN in its "Special Announcement" bulletin for 1900-1901, places before all those interested in mechanics and engineering, the advantages to be obtained in its college for that class of instruction.

COOPER UNION FREE DAY SCHOOL.—On Oct. 1 next the Cooper Union free day school for instruction in technical science will be opened in New York. The course of instruction is designed especially to supplement the scientific course of the high schools of the city. Instruction will be given by lectures, recitations and practical work at the laboratory tables. Provision is made for mechanical engineering, electrical engineering and civil engineering. The complete course will require three years study. Application blanks may be obtained by personal application at the office of the Cooper Union, or by letter addressed to the assistant secretary.

Trade Notes.

MR. A. H. MASON, who has been in business with Mr. Ralph Warmley at 41 Monroe Street, Memphis, Tenn., has withdrawn from that firm, and is now with the Electric Supply Company at 298 Second Street, Memphis.

WEATHERPROOF WIRE AND CABLES.—The Western Electric Company, Chicago, is carrying a large stock of weatherproof wire and cable, and can make prompt deliveries in almost any quantity. It makes a specialty of feeder cables for street railways and power plants.

THE MOLONEY ELECTRIC COMPANY, of St. Louis, reports a splendid transformer business right through the dull season. A complete stock of Moloney transformers is now carried by the W. R. Garton Company, Chicago, and the Northwest Electric Engineering Company, Portland, Ore.

THE ROAD TO SUCCESS.—The International Correspondence Schools, Scranton, Pa., have issued a leaflet giving directions to be observed by high-school graduates and others who are about to enter the active world of business. It emphasizes the advantages of home study, and gives some sound advice on the important subject with which it deals.

THE JOHNSON ELECTRIC SERVICE COMPANY, of Milwaukee, Wis., has been reincorporated with a capital of $800,000 The articles were filed by August H. Vogel, Warren S. Johnson and Amos A. L. Smith. The principal reason for enlargement of the capital of the company was to consolidate the various branches of the business in the Eastern and Middle States. These will be controlled from the Milwaukee headquarters.

MILWAUKEE, WIS.—At a meeting of the creditors of the Julius Andrae & Sons Company, held on July 17, it was unanimously voted to accept 50 cents on the dollar of the liabilities. The company will continue in business under the same management. There were creditors present from New York, Chicago, Philadelphia and other cities, and many of them offered to extend the same line of credits to the company they had in the past.

CHICAGO MICA COMPANY, whose main works are at Valparaiso, Ind., reports a remarkable increase in sales of its Micabond products. W. F. Hatch, secretary, is at present making his headquarters at its Ottawa office, and has closed contract for the entire output of one of the largest amber mica mines in the province of Ontario. Fully 75 per cent of the output of this mine is what is known to the trade as silver amber mica, and used exclusively in the manufacture of the Chicago Company's well-known "No. 104 Micabond."

ELECTRIC TRAIN LIGHTING.—In "A Little Talk with You on the Electric Lighting of Passenger Cars," a pamphlet lately issued by Jno. N. Abbott, vice-president and general manager of the Consolidated Railway Electric Lighting & Equipment Company, the advantages obtained by using this company's apparatus and an untechnical description of the same are given. Without going into minor, although important, details, the reader has learned by the time he reaches the last page a great deal about this interesting subject.

AUTOMOBILE EXPOSITION.—We are informed that manufacturers of automobiles are taking keen interest in the proposed automobile show, which is to be held in the Grand Central Palace, New York City, from Nov. 14 to Nov. 24 next. Mr. Marcus Nathan is the general manager of the show, and is stirring up an interest among all concerned. From the fact that the exhibition will be held concurrently with the horse show, it is expected that the thousands who usually visit the latter will also visit the automobile show. Everything points to a very large and interesting display.

WHEELER REFLECTOR COMPANY, 100 Purchase Street, Boston, Mass., has just issued a neat and complete catalogue, No. 22, devoted to its "Reflector Chandeliers." The mere enumeration of them occupies some 32 pages. They are triple-cone, lined with brilliant, silver-plated, mirror plate glass, and yield a soft, clear, uniformly bright light. There are special forms of opal glass reflectors, and of reflectors for different classes of work, all admirably adapted to their purpose. It has also issued catalogue No. 21, which treats solely of headlights, oil and electric, and illustrates as well as describes a number of its successful specialties in this line.

AUTOMATIC TELEPHONES.—The Holtzer-Cabot Electric Company, Brookline, Mass., has just issued a leaflet containing a partial list of the users of Ness automatic telephones. The territory covered by the list extends from Maine to California, taking in many of the Southern States.

Record of Electrical Patents.

UNITED STATES PATENTS, ISSUED JULY 24, 1900.

[Conducted by William A. Rosenbaum, Patent Attorney, Times Bldg., N. Y.]

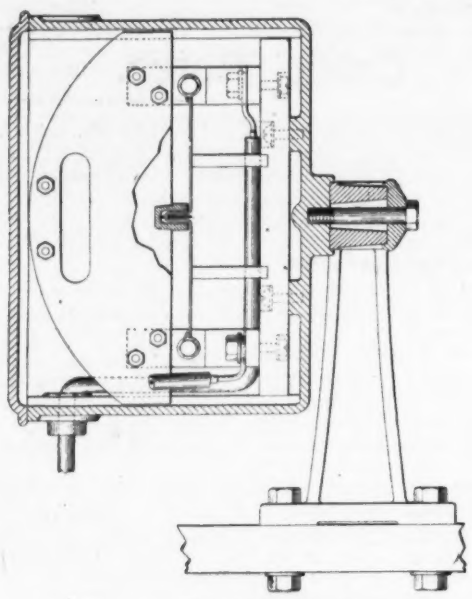
654,138. ELECTRIC CURRENT GROUNDING DEVICE FOR FIRE EXTINGUISHING APPARATUS; W. R. Dennett, Springfield, Mass. App. filed March 14, 1900. To prevent live wires from damaging fire engines or ladder trucks, the vehicle is provided with a flexible conductor, one end of which is connected to its metallic frame, while the other end is provided with means for attaching it to a fire plug for grounding purposes.

654,187. ELECTRICAL SAFETY FUSE; A. L. Stevens, New York, N. Y. App. filed Aug. 16, 1899. The terminals of the fuse, and its body for the most of its length, are submerged in oil.

654,239. ELECTRIC SWITCH; W. Ely, Providence, R. I. App. filed May 24, 1897. Details.

654,277. ELECTRIC ARC LAMP; H. Pieper, Jr., Liege, Belgium. App. filed Dec. 28, 1897. The shunt magnet operates upon a pivoted frame carrying a pawl which engages with a ratchet wheel geared to a drum over which a cord attached to the carbons passes.

654,299. STARTING MECHANISM FOR ALTERNATING-CURRENT MOTORS; J. J. Wood, Fort Wayne, Ind. App. filed March 30, 1900. Consists of a main switch, a commutator, a common lever for operating said switch and commutator, means whereby the initial movement of the lever renders it operative to close the main switch, and the continued movement thereof closes said main switch, and means whereby a backward movement



654,187.—Electrical Safety Fuse.

of the lever renders it inoperative to close the main switch until after it has been returned to its zero, or off position.

654,310. JUNCTION OR CONNECTION BOX; R. Hundhausen, Wilmersdorf, Germany. App. filed Nov. 18, 1899. The invention is a junction box containing the terminals of the supply circuit, a cover therefor, and a switch controlling the continuity of the mains, co-operating with the cover in such a manner that before the cover can be opened the switch will have to be operated to open the mains, and before the switch can be operated to close the circuit the cover will have to be closed.

654,320. ELECTRIC HEATER; R. I. Morison, San Francisco, Cal. App. filed Nov. 15, 1899. This is a pan arranged with electric heating apparatus and constructed especially for sterilizing surgical instruments.

654,325. AUTOMATIC SWITCH FOR ELECTRIC CAR-LIGHTING APPARATUS; W. F. Richards, Buffalo, N. Y. App. filed March 12, 1900. This is a centrifugal apparatus, arranged so that the switch lever will connect one set of contacts when the dynamo runs in one direction, and another set when it runs in the opposite direction, a checking device being used to prevent displacement of the lever in either of its extreme positions.

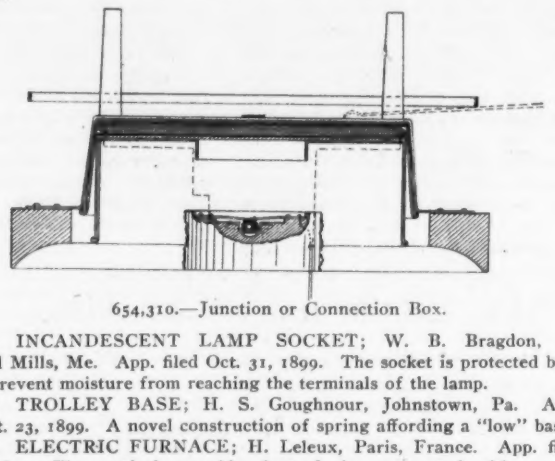
654,326. VOICE CONCEALING ATTACHMENT FOR TELEPHONE; H. P. Roberts, Boston, Mass. App. filed Jan. 15, 1900. The device comprises a body attachable to the transmitter and containing two chambers of non-vibrant material opening into each other in alignment, and in alignment with the mouth-piece.

654,341. DAMPING DEVICE FOR RECORDING INSTRUMENTS; W. H. & F. B. Bristol, Hoboken, N. J. App. filed May 24, 1900. The damping device is a peculiar form of dasher located in a body of liquid.

654,348. TROLLEY HARP; E. G. Johnson, Brigantine, N. J. App. filed Feb. 16, 1900. The wheel is at the centre of an elongated axle, and is held in position by springs on each side, which permit it to traverse the axle lengthwise.

654,355. ELECTRIC GAS LIGHTER; J. Y. Parke, Philadelphia, Pa. App. filed May 9, 1899. Details.

654,390. INDUCTION COIL; R. A. Fessenden, Allegheny, Pa. App. filed Dec. 1, 1899. An induction coil having a divided annular core and primary and secondary coils surrounding the core, and so arranged that at least a part of each coil surrounds the core on both sides of the gap between the ends of the core.



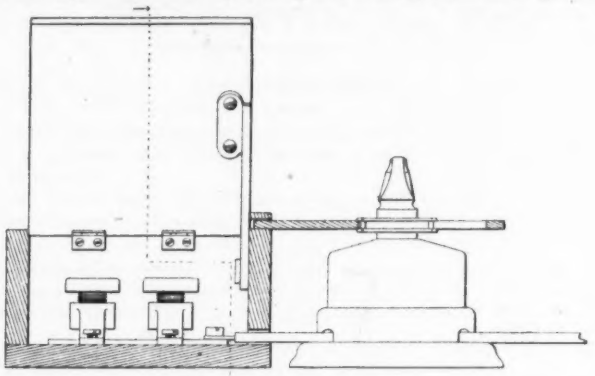
654,310.—Junction or Connection Box.

654,433. INCANDESCENT LAMP SOCKET; W. B. Bragdon, Cumberland Mills, Me. App. filed Oct. 31, 1899. The socket is protected by a hood to prevent moisture from reaching the terminals of the lamp.

654,448. TROLLEY BASE; H. S. Goughnour, Johnstown, Pa. App. filed Sept. 23, 1899. A novel construction of spring affording a "low" base.

654,463. ELECTRIC FURNACE; H. Leleux, Paris, France. App. filed July 7, 1899. The vertical, movable electrode is constructed with a protecting low-conducting shield which prevents combustion of the electrode when it is raised into the air.

654,467. FURNACE FOR HEATING AND TREATING GASEOUS MIXTURES; J. Mactear, London, Eng. App. filed Sept. 16, 1899. This is a vessel adapted for uniformly heating and treating mixtures of gases which,



654,320.—Electric Heater.

for the purpose of causing chemical reaction of the components upon one another, require to be exposed to a high temperature.

654,498. ELECTRIC METERING SYSTEM; F. E. Town, Glencarlyn, Va. App. filed May 11, 1900. The main object of this invention is to provide means for registering the amount of current used at different times during the period of consumption, such, for instance, as when the load is heaviest and when it is lightest.

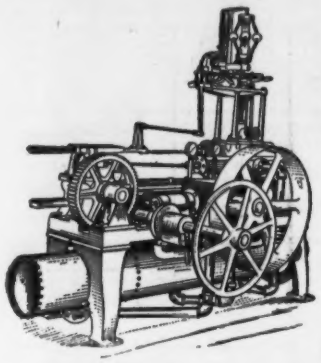
654,519. SECONDARY BATTERY; C. J. Coleman, Chicago, Ill. App. filed Oct. 2, 1899. A central conducting support is surrounded by a layer of active material, the invention consisting in inserting a collar of non-corrodable material at the neck of the support.

654,520. SECONDARY BATTERY; C. J. Coleman, Chicago, Ill. App. filed Oct. 2, 1899. Tubular holders for the active material are supported from a plate containing flanged openings into which the holders project.

654,531. ELECTRIC BELL; C. H. Furgason, Binghamton, N. Y. App. filed Oct. 2, 1899. Details.

654,551. MEANS FOR REGULATING ELECTRIC MOTORS; R. Lundell, New York, N. Y. App. filed May 19, 1900. This invention relates to the control of series-parallel electric motors, and consists of a controller having connection by which various novel relations between the fields and armature coils can be effected.

654,574. TROLLEY TRACK FOR ELECTRIC RAILWAYS; V. Koch, Scranton, Pa. App. filed Feb. 24, 1900. A crossing constructed from a circular plate integrally made, with projections thereon corresponding to the ends of the rails of the trolley track and adapted to be joined therewith to complete the circuit through the track.



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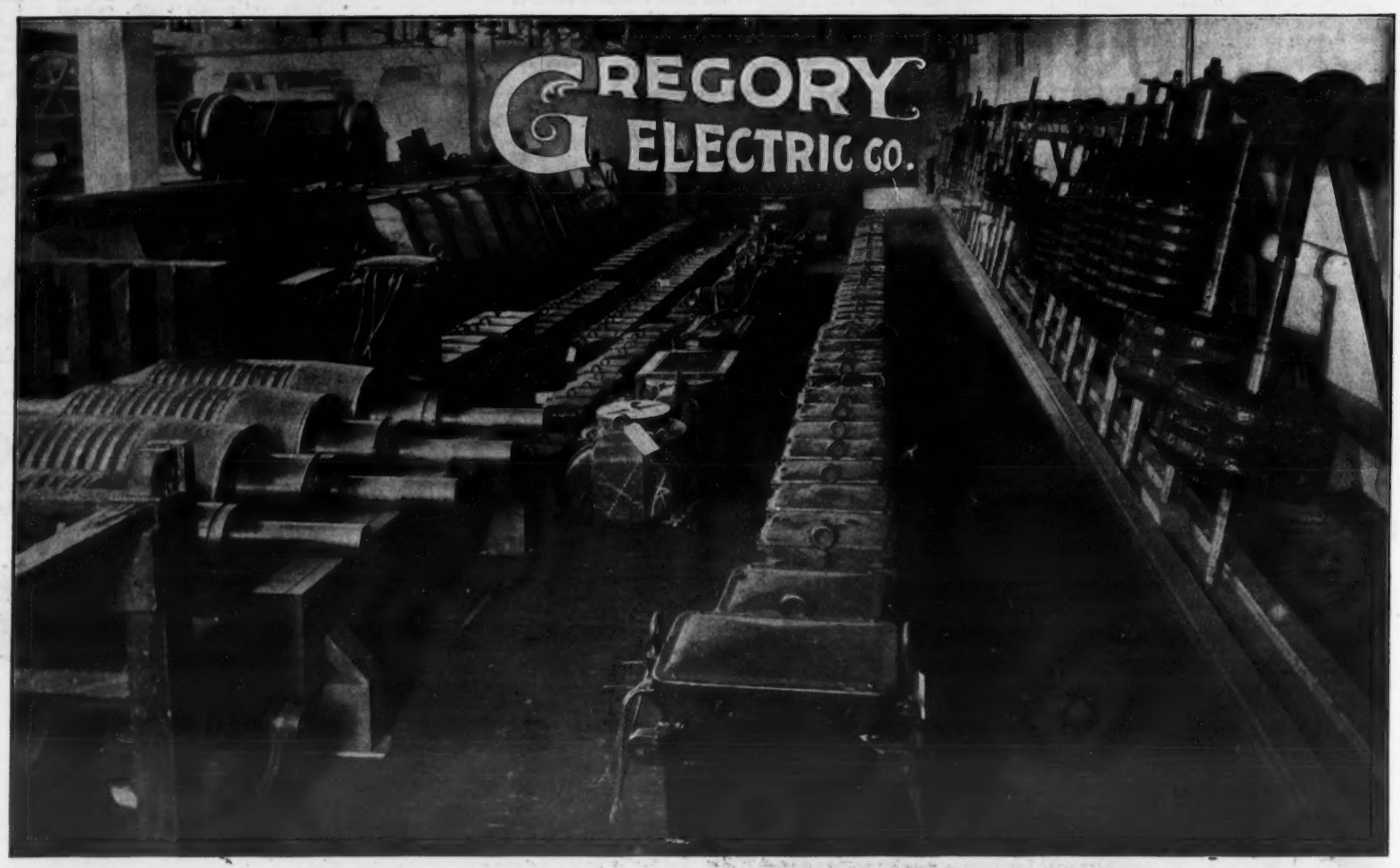

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1 150-kw Fort Wayne, 2200 or 1100 volts, 16,000 alternations.
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1 600 " T.-H., 30 K.W., two-phase.
1 600 " T.-H., 30 K.W., slotted armature, compound, self-oiler.
3 650 " T.-H., A35, s. o., composite wound.
2 750 " Westinghouse, s. o., 37½ K.W.
2 1000 " Wood, 50 K. W., s. o., toothed armature, comp. wound.
1 1200 " Westinghouse, 60 K.W., s. o., toothed armature.
1 1200 " Westinghouse, 60 K.W., s. o., comp., toothed armature.
1 1200 " G. E., A60, composite wound, toothed arm't, self-oiler.
2 1300 " T.-H., A70, s. o., compound wound.
2 1400 " Westinghouse, 70 K.W., brand new.
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1 25 " 2000 " T.-H., ball arm't.
1 25 " 2000 " T.-H., ring armature.
1 30 " 2000 " West. Electric, s. o.
1 30 " 2000 " Brush, No. 7, with latest improved Steubenrausch commutator.
2 35 " 2000 " T.-H., LD2.
1 35 " 2000 " T.-H., ring armature.
1 40 " 2000 " Wood, No. 7.
2 40 " 2000 " Western Elec., s. o.
4 45 " 1200 " T.-H., M12, ball arm.
1 45 " 1200 " T.-H., M12, ring arm.
2 45 " 1200 " Brush, No. 7, with latest improved Steubenrausch commutator.
1 50 " 2000 " Excelsior, latest type, newly rewound field and armature.
2 50 " 1200 " T.-H., LD12, ball arm.
1 50 " 1200 " T.-H., LD12, new ring arm't, oil cup.
1 50 " 1200 " T.-H., LD12, new ring arm't, s. o.
1 50 " 2000 " T.-H., MD2, s. o., ring armature.
1 50 " 2000 " West. Elec., s. o.
1 50 " 2000 " Brush, No. 7½.
2 60 " 2000 " West. Elec., s. o.
1 60-light 2000 C.P. Westinghouse, toothed arm't, 6-pole, D.C., s. o., complete with exciter.
3 60 " 2000 " Wood, No. 8.
3 65 " 2000 " Brush, No. 8, new arm't, extra fine, with latest improved Steubenrausch fireproof commutators.
1 65 " 2000 " Brush, No. 8, newly rewound fields and armature with latest improved Steubenrausch fireproof commutators.
2 75 " 1200 " Standard.
1 75 " 1200 " Standard, s. o., air-insulated commutator, complete, with regulator.
2 75 " 2000 " Westinghouse, s. o., toothed arm't, D.C., 6 poles, complete, with exciter.
3 125 " 1200 " Excelsior, latest type, self-oilers, fine.

110-VOLT INCANDESCENT DYNAMOS.

2 12-light Edison, ¼ K.W.
1 16 " Lundell, self-oiler.
1 25 " C & C, self-oiler.
1 35 " Westinghouse, self-oiler.
1 36 " Bernard, self-oiler.
1 50 " Hawkeve, self-oiler.
1 50-light Bain, self-oiler.
1 50 " Card, self-oiler.
1 50 " Nowotny, self-oiler.
1 50 " C & C, self-oiler.
1 55 " Edison, 3 K.W., self-oiler.
1 110 " Edison, 6 K.W., compound.
1 160 " Rockford.
1 210 " Triumph, self-oiler.
1 250 " Westinghouse, horizontal type.
1 250 " Commercial, comp., self-oiler.
1 270 " T.-H., comp., self-oiler.
3 270 " Westinghouse, M.P., s. s., 15 K.W.
1 340 " Eddy, self-oiler, compound.
2 350 " Hawkeye, comp. wound.
1 350 " National, self-oiler, compound.
1 360 " Rockford, self-oiler, compound.
1 350 " Edison, 20 K.W., shunt.
3 350 " Edison, 20 K.W., self-oilers.
1 350 " Edison, 20 K.W., self-oiler, compound.
1 400 " Wood, M.P., s. o., 25 K.W.
1 450 " Edison, 25 K.W., self-oiler.
1 450 " Rockford, self-oiler.
1 540 " Edison, 30 K.W.
4 540 " Edison, 30 K.W., self-oilers.
4 540 " Edison, 30 K.W., s. o., comp.
1 600 " Eickmeyer.
1 700 " Siemens & Halske, 40 K.W., multipolar, slow speed.
2 700 " Westinghouse, 10-pole, slow speed, 40 K.W., s. o., new.
1 800 " Rockford, s. o., new arm't.
4 800 " Edison, 45 K.W., self-oilers.
1 1350 " Waddell-Enz, 80 K.W., M.P., direct-connected to 125 H.P., self-oiling, 14x14 engine.

500-VOLT GENERATORS.

2 15 K.W. Edison, self-oilers.
1 25 " T.-H., self-oiler, D25, comp.
1 25 " Edison, self-oiler.
1 30 " Jenney, self-oiler.
1 35 " Jenney, self-oiler, compound.
1 35 " Mather, self-oiler.
1 45 " Edison, compound, self-oiler.
1 150 " Detroit (Rae), M.P., comp., s. o., new armature.
1 100 H.P., 500-volt Westinghouse, Kodak set Westinghouse generator and Westinghouse comp. engine, 14x24x14, all complete, fine.

110-VOLT MOTORS.

1 ¼ H.P. Sprague.
1 ½ " Elbridge.
1 ½ " Roth.
1 ½ " Keller, self-oiler.
2 1 " Belding, M.P.
1 1 " Roth, self-oiler, new arm't.
2 1 " Edison, ¾ K.W., self-oilers.
1 1 " Lundell, self-oiler.
1 1½ " C & C, self-oiler.
1 2 " Bernard, self-oiler.
1 3 " Hawkeye.
1 3 " Westinghouse.
1 3 " Jenney, self-oiler.
1 3 " Bain, self-oiler.
1 3 " Nowotny, self-oiler.
1 3 " Card, s. o., Manchester type.
1 5 " Wood.
1 3 " C & C, self-oiler.
1 4 " Edison, self-oiler.
1 7½ " Westinghouse.
1 7½ " Edison.
1 12 " Rockford.
1 15 " Triumph, self-oiler.
1 18 " Westinghouse, horiz. type.
1 18 " National, self-oiler.
1 18 " Commercial, self-oiler.
1 18 " T.-H., self-oiler, D15.
3 20 " Westinghouse, M.P., s. s.
1 24 " Eddy, self-oiler.
2 25 " Hawkeye.
1 25 " Rockford.
1 25 " Edison, 20 K.W.
4 25 " Edison, 20 K.W., self-oilers.
1 25 " National, self-oiler.
1 30 " Edison, 25 K.W., self-oiler.
1 30 " Rockford.
1 30 " Wood, M.P., self-oiler.
1 35 " Edison, 30 K.W.
5 35 " Edison, self-oilers, 30 K.W.
1 40 " Eickmeyer.
1 50 " Siemens & Halske, M.P., self-oiler, slow speed.
2 50 " Westinghouse, 10-pole, s. s., 50 K.W., s. o., new.

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DYNAMOS.

2	10	K.W. Edison, 110-volt.
2	15	" " "
2	20	" " "
2	25	" " "
2	45	" " "
1	D50	" T.-H. "
2	16	" " "
1	80	" Ft. Wayne, 110-volt.
1	100	" M.P., G. E., 110-volt.
1	100	" M.P., West, 110-v.
2	17½	" M.P., G. E.

MOTORS.

1—12	H.P.	C & C, 220 volts.
1— 5	"	one-phase, Ft. W.
1— 3	"	" "
1— 3	"	110-volt C.-W.
1—20	"	500 " Elliot, L.
3—10	"	500 " Jenney.
1— 2	"	220 " Edison.
1— 3	"	500 " Detroit.
1— 2	"	500 " C. & W.
1—¼	"	C & C, 115 volts.
1—23	"	M.P. Maine, 220-volt

ALTERNATORS.
(Single-phase.)

1—	30	K.W. West, 1040-volt.
1—	30	" G. E., 1040-volt.
1—	30	" National, 1040-volt.
2—	A35	" T.-H., 1040-volt.
1—	A70	" " "
2—	A60	" " "
2—A120		" " "
1—A240		" " "
2—	75	" West, two-phase.
1—	60	" Stanley, two-phase.
1—	120	" West, two-phase.

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Diehl Ceiling Fans.
6— 85 Volts, Brass finish.
5—100 " Black finish.
5—100 " Nickel finish.
6—170 " "
4—250 " "
4—250 " Black finish.
at $11.00 each.
104-volt, 16,000 alt., Emerson and G. E., fans (desk), at $6.50 each.

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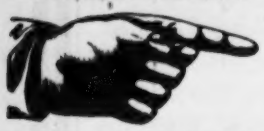

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2-120	"	Gen. Elec.
1-100	"	Gen. Elec.
1- 60	"	Stanley.
1- 60	"	Gen. Elec.
1- 50	"	Ft. Wayne.
1- 50	"	West'ghouse.
1- 45	"	West'ghouse.
2- 37	"	West'ghouse.
1- 35	"	T.-H.
1- 30	"	Gen. Elec.
1- 30	"	West'ghouse.

ARC DYNAMOS.

2-160	Lt.	Brush.
2- 80	"	Brush.
4- 60	"	Brush.
2- 50	"	Wood.
1- 50	"	T.-H.
1- 35	"	T.-H.
1- 30	"	T.-H.

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1-200	"	McI. & S.
1-175	"	Ideal.
1-150	"	Ball.
1-150	"	Russell.
3-125	"	Ball.
1-100	"	Payne.
1-100	"	Ball.
1- 80	"	Ideal.
1- 75	"	A. & S.
1- 65	"	N. Y. Safety.
1- 60	"	Ball.
1- 50	"	West'ghouse.

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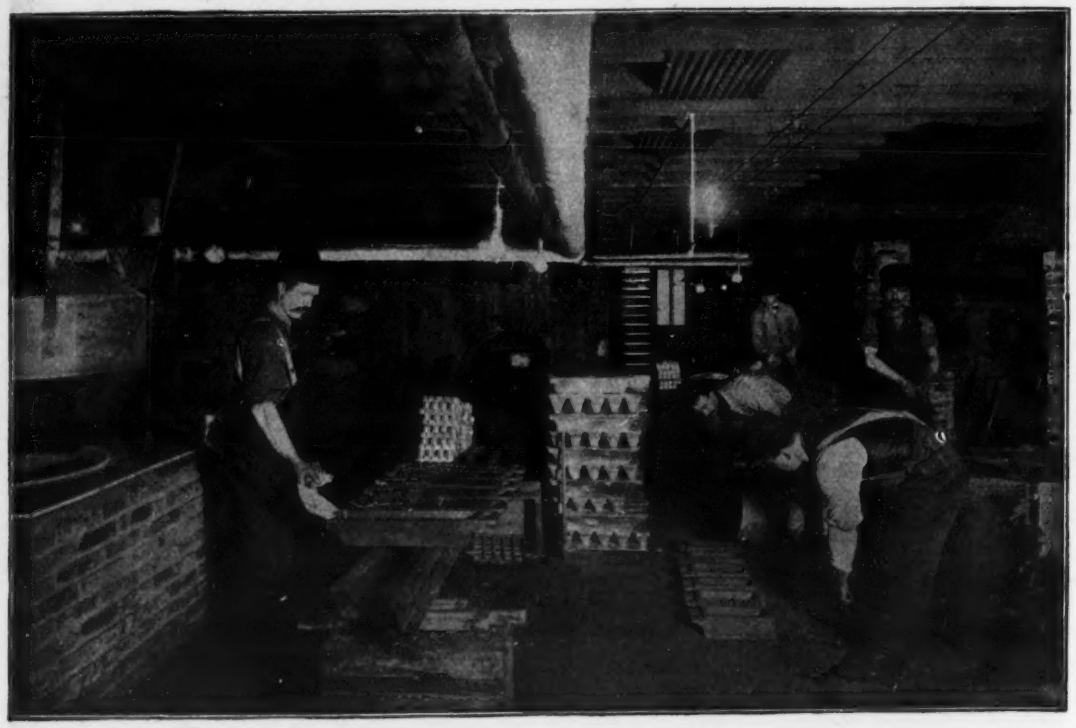

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1	" 110 v. Eddy.	35 "	T.-H.	135 " Armington & Sims.
1	" 220 v. C & C.	100 "	West. Elec.	150 " " "
1	" 500 v. Detroit.	2-160 "	Elec.-Dynamic.	150 " Vertical boiler.
2	" 110 v. Eddy.	300 "	U. S.	2-66x16 R. T. boilers.
2	" 220 v. Excelsior.	450 "	Onondaga.	
3	" 220 v. Mayer.	15 K.W.	Detroit.	
3	" 220 v. Sprague.	20 "	T.-H.	
7½	" 110 v. C & C.	2- 45 "	West, M.P., almost new.	**Large stock of ELECTRIC FANS, all voltages, new and second-hand; also TRANSFORMERS.**
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10	" 220 v. T.-H.			
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20	" 220 v. C & C.	1-100 "	West, 6-pole.	
10	" 500 v. "	45-light	T.-H. arc, circular armature.	
15	" 220 v. "			
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One single spindle Slate sensitive drill, with chuck and countershaft; in good, fair order.

One three-spindle novelty drill, with countershaft; in good order.

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One No. 1 Garvin cutter grinder on stand, with attachments and countershaft; in good order.

One 15" Gould & Eberhardt, crank shaper, with detachable knee, swivel base vise and countershaft; in good, fair order.

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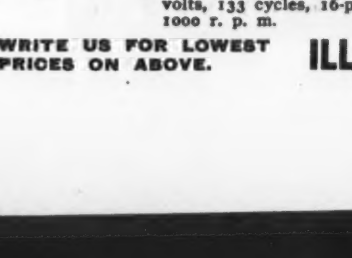

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1—2500-light, 150 K.W. General Electric, 6-pole, 550 r. p. m.
2—1600 " 100 K.W. Edison, bipolar.
1—1200 " 65 K.W. General Electric, 4-pole, 825 r. p. m.
6— 810 " 45 K.W. Edison, bipolar.
2— 540 " 30 K.W. Edison, bipolar.
1— 270 " 15 K.W. Edison, bipolar.
1— 30 K.W. Edison, bipolar, 220 volts.
1— 30 " Jenny, 725 r. p. m., 220 v.

500 VOLT RAILWAY GENERATORS.
1—New 120 K.W. Mather, 4-pole.
1—New 80 " Eddy, Type G, 4-pole, 700 r. p. m.

ALTERNATING GENERATORS.
2—120 K.W. Westinghouse, single-phase, 1100 volts, 16,000 alternations, comp. wound, iron clad, self-oiling, complete with Exciters.
1— 37½ " Slattery, single-phase, 1100 volts, with Exciter.
2— 30 " Westinghouse, single-phase, 1100 volts, with Exciters and instruments.
1—New 360 K.W. Stanley, two-phase, 2400 or 2200 volts, 16,000 alt., 460 r. p. m.
1—New 150 K.W. Stanley, two-phase, 2200 or 1100 volts, 16,000 alt., 800 r. p. m.
1—New 50 K.W. Stanley, two-phase, 2400 or 2200 volts, 16,000 alt., 1333 r. p. m.
1—New 40 K.W. Stanley, two-phase, 2400 or 2200 volts, 16,000 alt., 1333 r. p. m.

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1— 90 " Standard single-phase, 2000 volts, 133 cycles, 16-pole, 1000 r. p. m.
1—200 K.W. Fort Wayne, single-phase, 1100 volts, 700 r. p. m., 125 cycles, 24-pole.
1—240 " Stanley, two-phase, 1100 v., 400 r. p. m., 125 cycles, 40-pole.
1— 50 " National, single-phase, 2000 volts, 125 cycles.
1—100 " T.-H., single-phase, 1100 v., 125 cycles, 1000 r. p. m.

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1—60-light Wood, 2000 C.P.
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1—50 " T.-H., 1200 C.P.
1—40 " Ball, 1200 C.P.
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4—350 H.P. Heine Safety, 125 lbs.
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2—110 H.P. 66 in. x 18 ft., 100 lbs., Hawley furnace.
2—125 " 72 in. x 16 ft., 125 lbs., built in '97; with 1—48 in. x 80 ft. stack.
3—125 " 66 in. x 18 ft., 125 lbs.
4—125 " 66 in. x 16 ft., 100 lbs., with Murphy stokers.
3—110 " 66 in. x 16 ft., 100 lbs.
2—100 " 66 in. x 16 ft., 90 lbs.
4— 80 " 60 in. x 16 ft., 100 lbs.
2— 50 " 44 in. x 16 ft., 100 lbs.
6—50 H.P. 44 in. x 16 ft., 80 lbs.; without fronts.
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2—Vindex, capacity 20 lights.
1—Diamond, capacity 20 lights.
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2—T.-H., 5E.
11—New Stanley, C Type, capacity 10 lights, primary 2000, secondary 100 or 50.
5—New Stanley, C Type, capacity, 15 lights, primary 2000, secondary 100 or 50.
1—New Stanley, capacity 20 lights, primary 2000 or 1000, secondary 100 or 50.
1—New Stanley, capacity 30 lights, primary 2000 or 1000, secondary 100 or 50.
1—New Stanley, capacity 40 lights, primary 2000 or 1000, secondary 100 or 50.
3—New Stanley, capacity 50 lights, primary 2000 or 1000, secondary 100 or 50.
1—New Stanley, capacity 75 lights, primary 2000 or 1000, secondary 100 or 50.
1—New Stanley, capacity 100 lights, primary 2000 or 1000, secondary 100 or 50.

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1—50-light Standard, arc dynamo.
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1—600 H.P. Baragwanath, 40-in. diam., 13 ft. long.
1000 H.P. Austin, open.
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1—40-in., pulley, 18 in. x 8 in.
1—30-in., 14-in. discharge, 6-in. pulley.
Arc Lamp Posts: 27—Columbian type, Western Electric manufacture, practically new.
Festoons: For street decoration, 50 to 100 lights each, including wire, sockets and reflectors.
Starting Box: 1—Cutler-Hammer, 160 K. W., 200 volts, on marble panel, with separate resistance.
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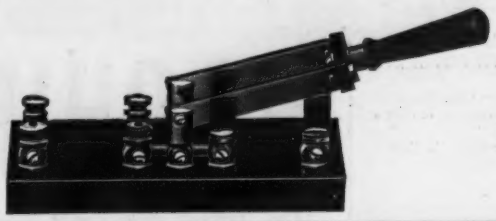

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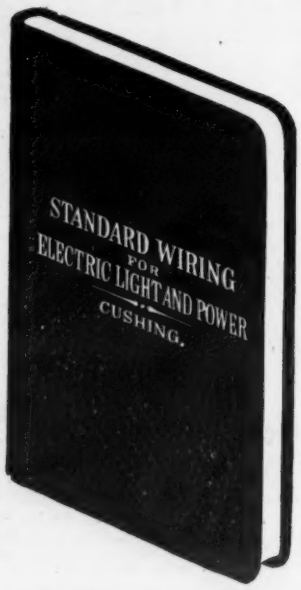

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